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ADDITIONS TO THE RHEOPHILOUS MOLLUSK FAUNA OF THE CONGO ESTUARY

BY JOSEPH C. BEQUAERT
AND W. J. CLENCH

WITH TWO PLATES

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No. 1.—*Additions to the Rheophilous Mollusk Fauna of the Congo Estuary*

(Studies of African Land and Fresh-water Mollusks, No. 13)

By Joseph C. Bequaert
and W. J. Clench

In a first account of the rheophilous mollusks of the Congo Estuary (1936, Mém. Mus. R. Hist. Nat. Belgique, sér. 2, fasc. 3, pp. 161–168), we anticipated the discovery of additional species in this peculiar habitat. Our prediction was fulfilled much sooner than we had hoped, due to the intelligent and active coöperation of Dr. M. Wanson. Following directions given by Dr. Maurice Bequaert, Dr. Wanson made extensive collections in the region of Matadi during 1938. The material, which he very generously sent us for study, contains, in addition to all previously known species, representatives of four new forms. Included also were many specimens of *Septariellina*, with the soft parts preserved, enabling us to give precise information concerning the relationships of this aberrant genus.

Dr. Wanson's outstanding discovery is the new *Potadoma agglutinans*. Owing to the peculiar habit of living in narrow crevices of rocks, immersed in swift current, this snail cements itself to neighboring objects, particularly to the walls of the crevice and often also to other individuals of the same species fixed to the rock in the vicinity. Abnormal growth of the shell results in all the adult snails being deformed, often much so.

While somewhat similar cementing of the shell to foreign objects is by no means rare in marine and fresh-water Pelecypoda, and occurring occasionally in marine Gastropoda, we know of no other comparable case in fresh-water Gastropoda. No doubt the adherence of *P. agglutinans* to foreign objects prevents the snail's being washed away by the swift current in which it is immersed. Yet the evolutionary significance of the process is not quite clear. The view might be taken that the cementing, as well as the abnormal shape, are merely due to mechanical pressure exerted on the snail while it grows in a cramped space from which it is no longer able to move. The resulting obvious advantage given the snail against the current would then be purely incidental, and the cementing would not be an adaptive process. A ready objection to this view is that, while mere mechanical pressure might explain the abnormal shape, it seems insufficient to account for the cementing to other objects. This latter process may require a

more profound change, perhaps of a physiological nature, in the method of secretion of shell material by the mantle. In view of these considerations, we suggest that it might be more rational to regard the cementing as the result of selection. Certain snails which developed the faculty of fixing themselves to foreign objects, were able to become adapted to the peculiar environment of rocks immersed in swift current, and thus had a survival advantage over others. In this connection it may be noted that *P. agglutinans* not only adheres to large objects, where pressure may be the main determining factor, but also incorporates in the shell smaller particles, where purely mechanical influences seem to be ruled out.

We cannot urge too strongly further intensive research in the estuaries of the Congo and other West African rivers (Coanza, Gaboon, Ogowe, Niger, Gambia, Senegal, and the many smaller coastal rivers), where equally surprising finds may well be made. In proof of this contention, we cite the recent unexpected rediscovery of *Potamopyrgus ciliatus* (Gould) by Dr. E. Dartevelle in the mangrove region of the Congo Estuary, between Malela and Banana. This snail was originally described from the Deea River, near Cape Palmas, Liberia. As it is extremely similar to *P. corolla*, of New Zealand, and as it had not been taken again in West Africa for nearly a century, some doubt had arisen as to the accuracy of the original locality. These misgivings have now been removed, and we may expect *P. ciliatus* to occur at many spots on the Coast of Guinea. Dr. Dartevelle found his specimens living in the burrows made by shipworms (*Teredo*) in the live aërial roots of mangrove trees (*Rhizophora Mangle*), while the burrows are still inhabited by the *Teredo*. These mollusks and some others (*Neritina* and *Cyrenoida*) seem to form a regular biocoenose.[1]

SYNCERIDAE (ASSIMINEIDAE)

Septariellina congolensis Bequaert and Clench

Plate 2, figs. 1–3

Dr. Wanson found this species living in large numbers, fixed to rocks in swift current, on the right bank of the Congo Estuary, a short distance above Matadi.

[1] Further details about this interesting association of mollusks will be awaited with interest. The rediscovery of *Potamopyrgus* was announced incidentally in a paper on the *Teredo* of the Congo Estuary by F. Moll (1939, Rev. Zool. Bot. Afric., **32**, p. 373), where it might be readily overlooked.

The species was described from a single dead specimen, 2.6 mm. wide and 1.8 mm. high. The largest specimen we have seen now measures: 6.8 mm. in greatest width, 5.2 mm. in height, 3.4 mm. in smallest diameter (seen from above), the aperture 4.6 by 5.2 mm.; but it has only the body-whorl left, the spire being completely corroded and replaced by a flat area near the columella. On the larger snails the growth-striae are cut by numerous, finely engraved spiral lines, which gradually spread apart toward the outer lip.

The preserved material sent by Dr. Wanson has made it possible to study the soft parts and to define more accurately the relationships of the genus. We had placed it, with some misgivings, in the Neritidae, but this allocation was erroneous.

A most careful examination of many animals has failed to disclose the slightest trace of an operculum. If this is present at all in the living animal, it must be very small or thin and drops off after death. We are convinced, however, that it has disappeared completely. As all other characters and particularly the radula remove the snail from the Basommatophora, we regard *Septariellina* as a fresh-water operculate which has lost the operculum. We know of no comparable case among fresh-water operculates, although the loss of the operculum is not so uncommon in the marine Gastropoda. Goodrich (1939, The Nautilus, **52**, p. 140) has noted the occasional loss, followed by regeneration, of the operculum in the Pleuroceridae, but this seems to be an abnormal or pathological process.

Other important features of *Septariellina* are the position of the eyes at the apex of the tentacles and the large penis placed dorsally to one side of the animal (Text fig. 1D). Males are rare, only one being found among some 75 snails examined.

The radula (Text fig. 1A) is decidedly of the Taenioglossate type and at once removes the genus from the Neritidae. On the whole it is similar to that of the Bulimidae and Synceridae. Central tooth unusually wide, with trilobate base and very elongate basal areas; on each side two long, sharp inner basal denticles; cutting edge with one large central cusp and five smaller cusps on each side. Lateral (or admedian) tooth fairly broad, with four unequal cusps; its base divided obliquely, setting off a plate adjacent to the base of the inner marginal. Inner marginal broad, with a prominent inner basal projection and about six subequal cusps. Outer marginal slender, with many cusps.

Assuming that *Septariellina* is an operculate which has lost the operculum, the position of the eyes at the tip of the tentacles and the division of the base of the lateral tooth into two plates refer the genus to

the *Synceridae*. According to Thiele (1927, Zool. Jahrb., Abt. Syst., **53**, pp. 113–146) this division of the lateral is the only peculiarity distinguishing the radula of all Syneeridae from that of all Bulimidae (Amnicolidae). Both families contain snails with and others without

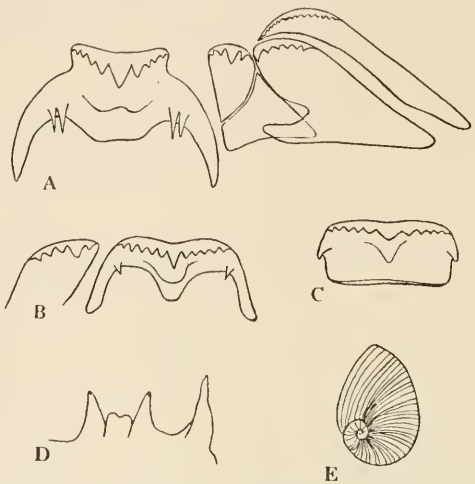

Fig. 1. A, radula of *Septariellina congolensis* Bequaert and Clench; B, radula of *Valvatorbis mauritii* Bequaert and Clench; C, central tooth of radula of *Potadoma agglutinans* Bequaert and Clench; D, tentacles and penis of *Septariellina congolensis;* E, operculum of *Potadoma agglutinans.*

basal inner denticles on the central tooth. In most Synceridae the accessory (detached) plate of the base of the lateral is more widely separated than in *Septariellina;* but Thiele's figure of the radula of *Syncera microsculpta* shows it in about the same position as in *S. congolensis.*

Pseudogibbula duponti Dautzenberg

Dr. Wanson found this species commonly on both banks of the Congo near Matadi, fixed to rocks in very swift current. How far up and down stream from the Vivi-Matadi area it extends remains to be worked out.

Our largest specimen, 8.5 mm. high and 6.3 mm. wide, has a corroded summit, so that the total number of whorls cannot be determined; only the last three whorls remain. Shells up to 1 mm. high and 1.5 mm. wide are complete, of 3 whorls: the first (embryonic) whorl is smooth, with-

out either axial or spiral sculpture; the next third of a whorl shows only microscopic spiral sculpture; after which the strong spiral ribbing and finer axial striation of the adult shell appear suddenly in full strength.

Pseudogibbula duponti pallidior subspec. nov.

A small lot of snails, from one colony on the banks of the Congo near Matadi, are all uniformly very pale dirty-yellow, instead of the usual dark chestnut-brown with violaceous tinge. No differences in size, shape or sculpture could be detected.

Holotype. Mus. Comp. Zoöl. No. 112265; paratypes, Mus. Comp. Zoöl. No. 112295. Dr. M. Wanson collector, 1938.

Valvatorbis mauritii Bequaert and Clench

Plate 2, fig. 9

Numerous specimens on stones of the banks of the Congo, in swift current, near Matadi. The species is probably as common as *P. duponti*, but more difficult to find, owing to its small size. No specimen exceeds 2.2 mm. in diameter.

The radula (Text fig. 1B), which we have only studied partly, is not incompatible with the Synceridae, where we placed *Valvatorbis*. The similarity of the central tooth with that of *Septariellina* is particularly striking; but there appears to be only one basal inner denticle on each side. We are unable to state, however, whether or not the base of the lateral is divided into two plates.

BULIMIDAE (AMNICOLIDAE)

Lobogenes schoutedeni Bequaert and Clench

Plate 2, figs. 11–12

Dr. Wanson collected many specimens of this minute snail from stones at the margin of swiftly running water in the Congo, at Kala-Kala near Matadi. None are larger than the types.

Lobogenes zairensis Bequaert and Clench

Plate 2, fig. 5

Four specimens of this species were found among the lot of *P. duponti pallidior*, with which they agree in color. They are similar to the type and about the same size.

Hydrobia plena Bequaert and Clench

Plate 2, fig. 10

A single specimen of this minute snail was found among a large lot of *Septariellina congolensis*, in the Estuary near Matadi. It appears to be adult, though only slightly larger than the type: 1.8 mm. high and 2.1 mm. wide. The outer lip of the aperture is slightly flaring and somewhat thickened, distinctly sinuate basally in profile, the columellar margin being again produced.

Hydrobia rheophila spec. nov.

Plate 2, fig. 4

Shell obtusely elongate-conic, thin, translucent, with closed umbilicus and very obtuse apex, colored a pale horny-yellow. Whorls four; first depressed (a little corroded); remainder rapidly increasing in size; second and third moderately convex; body-whorl strongly swollen, evenly rounded off at the periphery, rapidly tapering downward, taking in three-fifths of the height; sutures deep, simple. Surface shiny, with only weak, much spaced, vertical, slightly curved growth-striae; no spiral sculpture visible. Aperture simple, extending below the base of the body-whorl, about two-fifths of the height of the shell, narrowly ovate, vertical. Outer lip sharp, straight in profile (probably not fully formed). Columella slightly concave, thickened and folded back over the closed umbilicus. Operculum unknown.

Measurements:

Length	*Width*	*Aperture*	
3.6	1.8	1.0 x 1.5 mm.	Holotype; 4 whorls.
2.6	1.5	0.7 x 1.1	Paratype; 3½ "

Holotype (not fully adult). Mus. Comp. Zoöl. No. 112310, Estuary of the Congo River at Kala-Kala near Matadi, Belgian Congo. Dr. M. Wanson collector, 1938. Additional *paratypes* (all much younger), Mus. Comp. Zoöl. No. 112311, from the same locality and collector. These snails were found on stones in swiftly running water, together with *Lobogenes schoutedeni*.

Among the few described Ethiopian *Hydrobia* (= *Paludestrina*), *H. rheophila* appears to be related to *H. gabonensis* Morelet, of the Ogowe River (French Congo), which is only slightly larger (5.5 mm. high, 3 mm. wide, of 5½ whorls; adult *rheophila* may possibly reach that size). The shape of the shell, however, differs, *H. rheophila* being more coni-

cal, notwithstanding the more obtuse summit, with the body-whorl much more bulging.

TIARIDAE (MELANIIDAE)

POTADOMA WANSONI spec. nov.

Plate 1, figs. 9 and 11–12

Shell small, solid, though thinner than usual and somewhat translucent, elongate-conic, with slowly tapering spire (truncate through corrosion), rounded periphery and attenuate, imperforate base. Adult shells of 3 to 5 remaining whorls, at least 3 or 4 earlier whorls being lost (by comparison with the youngest shells in the type lot). Whorls slightly convex, with moderately impressed sutures, regularly increasing in size; body-whorl much longer than the combined preceding two whorls. Color a uniform, dull pale olivaceous-green, somewhat lighter in young shells. Outer lip thin and simple, strongly sinuate in profile, retracted near the suture, produced below. Aperture elongate-ovate, narrowly edged with black all around, not at all produced at the base. Columella slightly thickened; concave parietal wall thinly glazed. Sculpture of very fine, sinuous growth-lines; no trace of rippled spiral striation. Radula and operculum as in other species of the genus.

Measurements:

Length	*Width*	*Aperture*	
11.7	5.4	5.4 x 2.0 mm.	Holotype
11.7	5.6	5.0 x 2.1	Paratype
12.1	6.1	5.5 x 2.3	"

These specimens all with truncate summit.

Holotype. Mus. Comp. Zoöl. No. 112268, Estuary of the Congo River on the right bank, near Matadi, Belgian Congo. Dr. M. Wanson collector, 1938. Additional *paratypes*, Mus. Comp. Zoöl. No. 112269, from the same locality and collector. These snails live on rocks immersed in swiftly running water.

This is one of the smallest adult *Potadoma* known to us.[1] In general shape and smoothness, as well as in the absence of minute spiral sculpture, *P. wansoni* comes nearest *P. ignobilis* (Thiele), of the northeastern Belgian Congo; but the latter reaches at least twice the size, so that no confusion is possible.

[1] *Potadoma mayumbensis* Thiele (1928) was described from young specimens, 9 mm. long and 5 mm. wide. There is an adult of this species at the Mus. Comp. Zoöl., reaching 26 mm. in height

Potadoma agglutinans spec. nov.

Plate 1, figs. 1–8 and 10

Normal adult shape unknown, as all adult shells are more or less deformed through corrosion and adherence to rocks, dirt or other shells of the same species. Our smallest shell, 2.3 mm. long and 1.6 mm. in greatest width, consists of 4 whorls, with the apex apparently little or not corroded; it is turrited, of normal *Potadoma* shape, and strongly ribbed spirally. On the fourth whorl there are four ribs at the periphery, the upper one very prominent, the others gradually weaker. The largest normal shells seen (Pl. 1, fig. 5) are about 8 mm. long and 3.5 to 4 mm. in greatest width (at the last whorl); they are also turrited, but less slender than the younger shells, only four whorls being preserved; these are sculptured spirally with more numerous ribs, three very strong at the periphery, five or six weaker ones spaced over the basal third, and sometimes a very weak one midway between the suture and the periphery; in addition, there is a very fine axial sculpture of close set, somewhat curved growth-striae. All shells over 8 mm. long (and many smaller ones) are deformed, but they retain at least part of the sculpture of the normal younger stage. The holotype (Pl. 1, fig. 1) is relatively little deformed, being yet distinctly turrited; but the sutures are very deep and there is some adherence in spots to foreign matter. In other shells (Pl. 1, figs. 5–8 and 10) the later whorls bulge out abruptly and show the flattened areas cemented to stones or other shells. When the earlier and normal whorls persist, they often slant from the later, abnormal whorls. Aperture usually subcircular or slightly higher than wide, not produced at the base. Outer lip thin, not expanded, somewhat arched forward at the periphery. Parietal wall thinly glazed. Columella uniformly concave, with a thin fold extending over the narrowly rimate or nearly closed umbilicus. Color a dull pale olivaceous-brown. Radula (Text fig. 1C) much like that of *Potadoma ponthiervillensis*. Operculum (Text fig. 1E) of the usual *Potadoma* type.

Measurements of adults shells:

Length	*Width*	*Preserved Whorls*	
12.5	7.5 mm.	5	Holotype
11.5	6.3	5	Paratype
11.0	6.6	4	"
10.6	7.1	4	"
8.6	6.3	4	"

Holotype. Mus. Comp. Zoöl. No. 112267, Estuary of the Congo River, on the left bank at Kala-Kala near Matadi, Belgian Congo. Dr. M. Wanson collector, 1938. Additional *paratypes,* Mus. Comp. Zoöl. No. 112266, from the same locality and collector.

These snails were found in crevices of rocks immersed in very swiftly running water. The peculiar habitat explains the cementing of the shells to neighboring objects and the consequent irregularity in growth and shape. So far as we know, both features are unique, not only among the Melanians, but among all known fresh-water Gastropods. The young are free and move about in the crevices in which they hide; but the strength of the current obviously induces them to lodge in narrow spaces. As growth proceeds, new shell material deposited at the edge of the outer lip not only takes the shape of the wall of the crevice (or any object pressing against the aperture), but adheres to it. Once the aperture is partly attached in this manner, the snail will usually be unable to move, so that continued growth will cement it further and enhance the deformation. If young, free snails were removed from crevices and kept alive for some length of time in a less restricted environment, possibly "normal" adult shells might be obtained.

ADDITIONS TO THE LOWER CONGO FAUNA

The following species of land and fresh-water mollusks, collected by Dr. M. Wanson outside the Estuary, contain some interesting new records for the Belgian Congo. The sequence is that of Pilsbry and Bequaert's two volumes on the mollusks of the Belgian Congo (1919 and 1927).

Achatina bandeirana Morelet. Matadi.

Achatina tincta Reeve. Matadi.

Achatina pfeifferi cugrapta Pilsbry. Matadi.

Subulina (Nothapalus) paucispira mukongo subspec. nov.

Plate 2, figs. 6–8

Agreeing in most characters of the shell, including aperture and sculpture, with *S. paucispira* v. Martens, but consistently shorter and wider. Body-whorl nearly two-thirds and aperture a little less than one-third of the total length. The greatest width is about mid-length of the shell, not in the lower third as in typical *paucispira.* The shape

of the summit is as in *paucispira*, being very much narrower than in *Subulina* (*Nothapalus*) *laevigata* (Pfeiffer), of West Africa.

Measurements:

Length	*Width*	*Aperture*	*Whorls*	
16.8	5.6	6.4 x 2.7 mm.	6	Holotype
17.0	5.8	6.8 x 3.1	6	Paratype
15.6	5.3	6.3 x 3.0	6	"

Holotype. Mus. Comp. Zoöl. No. 112302, Luadi-Soyo near Matadi, Belgian Congo. Dr. M. Wanson collector, 1938. Additional *paratypes* Mus. Comp. Zoöl. No. 112304, from the same locality and collector.

We have reached the conclusion that *S. paucispira xanthophaes* Pilsbry is not separable as a race from typical *S. paucispira.*

Pseudoglessula strigosa (Morelet). Luadi-Soyo near Matadi.

Opeas gracile (Hutton). Matadi.

Ptychotrema bequaerti thysvillense Pilsbry. Luadi-Soyo near Matadi.

Ptychotrema (*Ptychotrema*) *pupaeforme* (Morelet). *Ennea pupaeformis* Morelet, 1866, Jl. de Conchyl., **14**, p. 154; 1867, Voy. Welwitsch, Moll. Terr. Fluv., (1868), p. 82, Pl. II, fig. 6; Mt. Cungulangulo, 2,000 ft., District of Gulungo Alto, Angola.—One specimen from Luadi-Soyo near Matadi. We have compared it with two of Morelet's cotypes and find the Lower Congo snail identical. E. v. Martens (1876, Monatsber. Ak. Wiss. Berlin, p. 268) suggested that *Ennea calameli* Jousseaume (1872, Rev. Mag. Zool., (2), **23**, p. 12, Pl. II, figs. 3–4; Novo Redondo, Angola) was possibly *P. pupaeforme.* This statement must have been made by an oversight, since *E. calameli* is too small for *pupaeforme* and clearly the same as *P. ringiculum* (Morelet).

Gulella monodon (Morelet). *Ennea monodon* Morelet, 1873, Jl. de Conchyl., **21**, p. 330 (Gaboon); Connolly, 1929, Ann. Mag. Nat. Hist., (10), **3**, p. 167, fig. 1 (type). One specimen from Luadi-Soyo near Matadi. It agrees well with Connolly's figure of the type, as well as with many specimens which the senior author collected in ten localities in Liberia.

Thapsia zambiensis Pilsbry. Luadi-Soyo near Matadi.

Gymnarion sowerbyanus (Pfeiffer). Luadi-Soyo near Matadi.

Succinea congoensis Pilsbry. Matadi.

Lymnaea natalensis succinoides Morelet. Lukunga River at Kimpese. This form is intermediate between typical *natalensis*, of South Africa, and var. *undussumae* v. Martens, of the Upper Congo.

Gyraulus misellus (Morelet). Matadi ("barrage Coco-Sambana"). Dartevelle and Schwetz have recently reported this species from the

island of Mateba in the Congo Estuary (1937, Ann. Soc. Zool. Belgique, **68**, p. 53).

Biomphalaria salinarum (Morelet). Lukunga River at Kimpese. This is probably no more than a race of *B. pfeifferi* (Krauss) of South Africa.

There is much to be said in favor of Major Connolly's recent treatment of all larger African Planorbinae as one genus, *Biomphalaria* (1939, Ann. South Afr. Mus., **33**, p. 484). These have also been placed or distributed variously in *Planorbis* (*sensu str.*), *Planorbula* and *Afroplanorbis*. Probably most, if not all of these African snails may sometimes produce internal folds or teeth in the young shells, like the North American *Planorbula;* but, as F. C. Baker (1940, The Nautilus, **53**, p. 106) points out, these lamellae have arisen independently in otherwise unrelated groups. Several of the young *salinarum* from the Lukunga River, up to 5 or 6 mm. in greatest diameter, show the internal barrier of lamellar teeth.

Bulinus senegalensis crystallinus (Morelet). Matadi ("barrage Coco-Sambana"), very common on dead leaves. The specimens were compared with Morelet's cotypes.

Lanistes congicus O. Boettger. Lukungu River at Kimpese.

Caelatura bomae Pilsbry. Matadi, many specimens on the banks of the Congo, in quiet water. We have it also from Ango-Ango, below Matadi. In our opinion, this is a distinct species, not a race of *C. stagnorum* (as originally described) nor a synonym of *C. bourguignati* (de Rochebrune) as claimed by Haas (1936, Abh. Senckenb. Naturf. Ges., 431, p. 66). It differs consistently from *bourguignati*, not only in shape, but also in the presence of many fine, close set, regular radiating corrugations behind the beaks, over nearly the upper third of the valves. In *C. bourguignati* this area bears only a few, irregular, much spaced, not radiating folds.

On the other hand, we agree with Haas (*loc. cit.*) that *Unio stagnorum* Dautzenberg and *Caelatura rotula* Pilsbry and Bequaert are synonyms of *Caelatura bourguignati* (de Rochebrune).

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. *Potadoma agglutinans* Bequaert and Clench; holotype, X 5.
Figs. 2 and 3. *Potadoma agglutinans* B. and C.; young paratypes, X 4.
Figs. 4–8 and 10. *Potadoma agglutinans* B. and C.; paratypes, X 4.
Figs. 9 and 12. *Potadoma wansoni* Bequaert and Clench; paratypes, X 3.
Fig. 11. *Potadoma wansoni* B. and C.; holotype, X 3.

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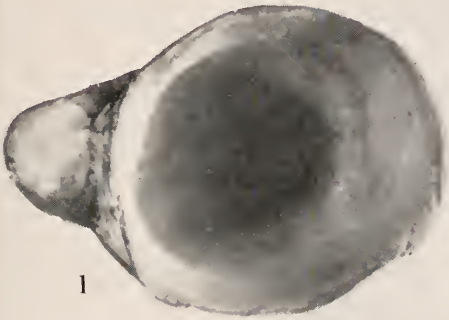
PLATE 2

PLATE 2

Figs. 1–3. *Septariellina congolensis* Bequaert and Clench; X 8.
Fig. 4. *Hydrobia rheophila* Bequaert and Clench; holotype, X 10.
Fig. 5. *Lobogenes zairensis* Bequaert and Clench; holotype, X 10.
Figs. 6–7. *Subulina (Nothapalus) paucispira mukongo* Bequaert and Clench; paratypes, X 3.
Fig. 8. *Subulina paucispira mukongo* B. and C.; holotype, X 3.
Fig. 9. *Valvatorbis mauritii* Bequaert and Clench; holotype, X 10.
Fig. 10. *Hydrobia plena* Bequaert and Clench; holotype, X 10.
Figs. 11–12. *Lobogenes schoutedeni* Bequaert and Clench; holotype, X 10.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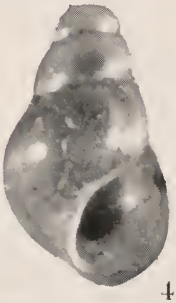
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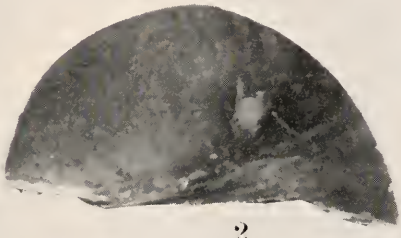
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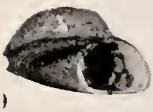
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MILLIPEDS COLLECTED IN PUERTO RICO AND THE DOMINICAN REPUBLIC BY DR. P. J. DARLINGTON IN 1938

By H. F. Loomis
Bureau of Plant Industry
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No. 2.—*Millipeds Collected in Puerto Rico and the Dominican Republic By Dr. P. J. Darlington in 1938*[1]

By H. F. Loomis

During the summer of 1938 Dr. P. J. Darlington, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts, gathered much zoological material in Puerto Rico and the Dominican Republic which included a large number of very interesting millipeds, later sent to me for identification, and now forming the basis for this paper.

The Puerto Rican collection of millipeds contained 11 species, and has been exceeded in number only by that of 12 species by Prof. W. M. Wheeler in 1906, and reported on by Silvestri[2]. Four species of the Darlington collection are here described as new, one being made the type of an unusual new genus of the family Stemmiulidae. With these additions, thirty species now have been recorded from Puerto Rico, but the identity of five is in doubt and cannot be settled until much more collecting and study have been done.

In the Dominican Republic 35 species were found, and these represent the first extensive collection ever to come from that country, where previously only six species had been known, one of those also being reported from the adjacent Republic of Haiti. In the Darlington collection are six previously described species, one of which was already known from the Dominican Republic, the remaining five being newly discovered there but previously known from Haiti. Twenty-eight of the species, apparently new to science, are described in the following pages, and among them are the types of eight new genera. A single remaining form was represented by inadequate material, impossible to identify specifically.

The Dominican portion of the collection is remarkable in the number of new species of *Prostemmiulus* and *Microspirobolus* it contains; and in the many new monotypic genera of the order Merocheta it has been necessary to erect to fit the animals into the current system of classification. These genera are indicative of a large undiscovered milliped fauna, and future collections in other parts of the country hardly can fail to add species to some of them. Great localization of milliped species already has been noted in Cuba[3], and especially in the Republic of Haiti[4], whence 108 species have been reported. The Dominican Republic, with double the area of Haiti, remains almost wholly unknown,

[1] Published with the aid of a special gift from Mr. George R. Agassiz.
[2] Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 563–578, 1908.
[3] Bull. Mus. Comp. Zool., Vol. 82, No. 6, pp. 427–480, 1938.
[4] Bull. Mus. Comp. Zool., Vol. 80, No. 1, pp. 3–191, 1936.

as far as millipeds are concerned, in spite of the present collection, and a milliped fauna comparable to that of Haiti may be expected. Another unusual feature of this collection, for which no explanation is offered, is its complete lack of species of *Cyclodesmus*. Thirteen species of this genus are known from Haiti, and its distribution certainly must extend into many parts of the Dominican Republic.

Combining the faunas of the Haitian and Dominican Republics, 141 species of millipeds now are credited to the Island of Hispaniola, but this number will be increased with each new collection from there, especially if made in hitherto unvisited regions.

Types, paratypes and all other specimens in the collection are in the Museum of Comparative Zoölogy.

GLOMERIDESMIDAE

Glomeridesmus pectinatus spec. nov.

The type, and another male and a 20-segmented female from El Yunque, Puerto Rico, May 1938.

Diagnosis. Intermediate in size between *G. marmoreus* Pocock and *G. trinidadensis* Loomis but readily distinguished from the former by the more rectangular shape of the pleurae which have a comb-like border of fine setae along the posterior margin in contrast to the simple margin found in the latter species.

Description. Length from 8 to 9.5 mm., width to 2 mm.

Fig. 1. *Glomeridesmus pectinatus.* Last two joints of last leg of male.

Color of head and antennae dark; first segment dark with a median W-shaped figure of white with the free ends of the figure forward; laterad of this figure, in the outer angle, is a small white spot; ensuing segments dark with a large white spot in front a third of the way to the lateral margin, the spots much smaller on the caudal third of the body; segments 2 to 4 or 5 with an additional smaller white spot in front on

each side at the median line; sides of all segments white or colorless for a distance above the lateral margin; legs and ventral surfaces colorless; one specimen, less fully colored than the others, has the head, first segment, and the outer third of the other segments colorless.

Head with the entire clypeal region swollen, forming a broad transverse elevation, on the posterior limits of which many small erect setae are evident, especially near the sides of the head, a few larger setae farther forward; pit behind the antennal socket much larger than the socket and much more nearly circular than in *G. marmoreus* as shown by Pocock's illustration.

First segment much exceeding the width of the head, in the proportion of five to four.

Caudal segments with each posterior corner produced into a small acute tooth.

Pleurae rectangular, the exposed portion broader than long, surface smooth, the posterior margin fringed with a comb of fine setae except near the outer angle.

Coxal joints of the legs broader and less angular than in *G. marmoreus;* the posterior margin simple, neither toothed nor setose.

Last leg of male with the two outer joints as shown in figure 1, the last joint apparently with a tiny peg-like claw.

Chamberlin reported[1], without mention of size, color, or structural characters, a single specimen of *Glomeridesmus* from El Yunque, which he referred to *G. concolor,* described from Haiti as being from 4 to 6.5 mm. long. It now appears more probable that this specimen should be placed under *G. pectinatus* rather than under the Haitian species.

SIPHONOPHORIDAE

Siphonophora platops spec. nov.

Two males (one the type) and two females from rain forest near Valle Nuevo, 6,000 feet elevation, Cordillera Central, Dominican Republic, August 1938.

Diagnosis. A more robust species than any previously known from the island, its proportions being quite similar to *S. robusta* Chamberlin of Jamaica from which it differs in the much shorter antennae.

Description. Body stout, the dorsum strongly convex, densely velvety pubescent; color light yellow in alcohol but probably white in

[1] Proc. U. S. Nat. Mus., vol. 61, art. 10, p. 1, 1922.

life; segments 44 and 45 for the males, 55 and 61 for the females; largest male 11 mm. long and 1 mm. wide, largest female 20 mm. long and 1.5 mm. wide.

Head rather flattened from the base of the slightly decurved beak to the moderately swollen vertex and with the pubescence longer but not as abundant as that on the segments or on joints 5 and 6 of the antennae. Head and antennae shown in figure 2, *a*, the antennal

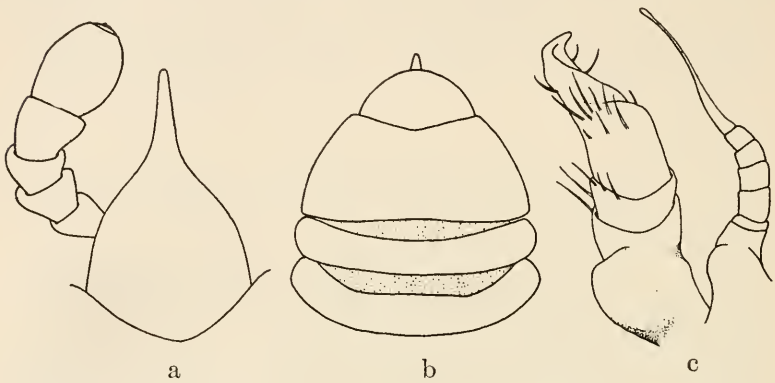

Fig. 2. *Siphonophora platops*. *a*, Head and antenna, vertical view; *b*, Segments 1 to 3 in vertical view, the head deflexed; *c*, Gonopods, outer lateral view.

sockets far around on the ventro-lateral surface, the first joint and basal portion of the second one not visible from above; antennae strongly clavate, the sixth joint longest and broadest, the seventh joint small and exceedingly short, scarcely projecting beyond the sixth joint and only half as wide.

First segment with sides sharply diverging from in front, over twice as wide behind as the head and almost as wide as the greatest diameter of the body (Fig. 2, *b*).

Gonopods shown in figure 2, *c*, the apex of the stout anterior pair bent sharply inward and backward.

Legs in advance of the gonopods almost similar in size, the first pair slightly shorter than the eighth pair.

STEMMIULIDAE

Prostemmiulus quintarius spec. nov.

The male type and four females from the Maricao Forest, about 2,500 feet elevation, western Puerto Rico, June 2 and 3, 1938.

Diagnosis. Insofar as is known this is the only species having pleural lobes on the fifth segment of the male. The gonopods associate the species with the much smaller *P. wheeleri* Silvestri, from the small island of Culebra, 20 miles east of Puerto Rico.

Description. Body strongly compressed laterally; moderately subulate, the last 15 segments narrowing gradually; number of segments

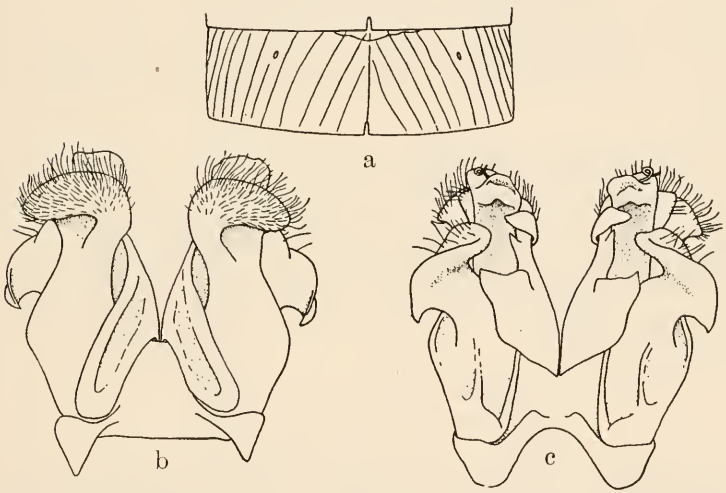

Fig. 3. *Prostemmiulus quintarius. a,* Segment from middle of body, dorsal view; *b,* Gonopods, anterior view; *c,* Gonopods, posterior view.

46 to 49; length 27 to 31 mm; males obviously more slender than females.

Color in alcohol dark slate gray, an interrupted light median line on the dorsum consisting of a very narrow line on the prozonite of each segment, part of which shows through the transparent posterior portion of the overlapping metazonite; a small light spot or mottled area at each pore with another half way between it and the base of the legs; antennae with joints 1, 6 and 7 light in color.

Head with sulcus of vertex very faint or entirely lacking; antennae long and slender, the joints of about equal width; joint 2 longest, joint 3 next in length with joints 4 and 5 slightly shorter, subequal, joint 6 two-thirds as long as joint 5; ocelli of moderate size, the posterior one half as wide as the antennal socket, the anterior one from half to nearly as large as the other; mandibulary stipe pointed in front, the upper and lower margin with a raised rim, stipe of female wider than that of male.

First segment with two or sometimes three primary striae, below which, on the subventral surface, shorter secondary striae are present.

On ensuing segments the oblique striae are sharply marked, first reaching the broad, impressed median sulcus on segment 9 or 10, the striae on a mid-body segment are shown in figure 3, *a*, as typical of the genus and for comparison with the striae of the new Puerto Rican genus *Scoliogmus;* notch at posterior end of median sulcus deep but narrow; serration of the posterior margin above the feet strong and acute.

Preanal scale broadly rounded-truncate behind.

Gonopods as shown in figure 3, *b* and *c*.

Second legs of male much like those of *P. wheeleri*.

Male with pleurae of segment 3 simple, not produced; pleurae of segment 4 each carried inward as a narrow, mesially rounded lobe, with a raised rim around the entire margin; pleurae of segment 5 each carried inward in a shorter and broader lobe; pleurae of ensuing segments normal.

Prostemmiulus iuloides spec. nov.

Three males (1 the type) and 9 females from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Dominican Republic, June 1938. Additional specimens collected the same month from between 5,000 and 8,000 feet elevation from Loma Rucilla and mountains north, Cordillera Central, Dominican Republic.

Diagnosis. Aside from the gonopods, which are of the greatest importance in differentiating the species of this genus, this species shares with only *P. scaurus* and the much smaller *P. gracilipes* the peculiar character of having the side of the first segment of the male, below the lateral stria, continuous in contour with the surface above the stria, not at all bent under as is usual in the female and in both sexes of other species. From *P. scaurus* it differs in the caudally bent first legs of the male and the unmodified third legs.

Description. Body long and slender, much like *Paraiulus*, gradually narrowing from behind the middle of the body; the first segment of the males enlarged, wider posteriorly than remainder of body; number of segments 48 to 49, length 25 to 26 mm.

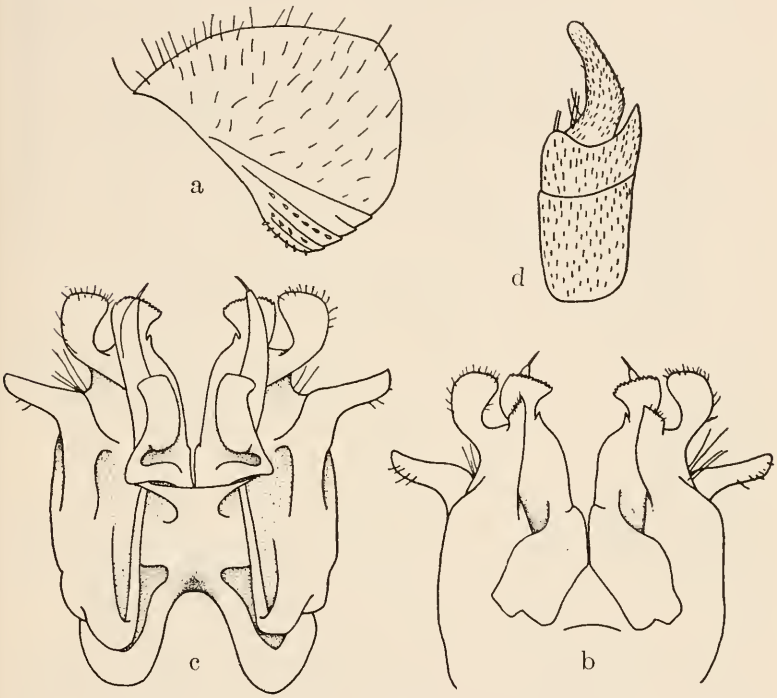

Fig. 4. *Prostemmiulus iuloides. a,* Segment 1, lateral view from slightly in front; *b,* Gonopods, anterior view; *c,* Gonopods, posterior view; *d,* Second leg of male, anterior view.

Color in alcohol rather dark brown except the first three segments, which are slightly lighter, especially in the males, and the light brown median line; the usual light spots on the side of each segment are faintly indicated.

Head with small eyes, the anterior ocellus about half as large as the posterior which is less than half as broad as the antennal socket; antennae with joint 2 longest; joints 3, 4, and 5 subequal; joint 6 two-thirds as long as joint 5; furrow of the vertex short but well im-

pressed; mandibulary stipe of male rounded-truncate in front, ventral fourth depressed above the margining rim, the remainder of the surface raised in a sharply angular longitudinal swelling; stipe of female wider but less sharply swollen and more pointed in front.

First segment as shown in figure 4, *a*, with numerous fine setae scattered over the surface; in the females there is a single primary stria along the lower anterior margin, the surface below it, bearing the secondary striae, limited in area and somewhat bent under, partially hiding the striae in lateral view; in the male the surface bearing the secondary striae is much larger and is not bent under but is continuous with the surface above the primary stria; the intervals between the secondary striae bear a single series of strongly clavate setae similar to those on the first male legs; clavate setae also are present on the lateral intervals of segments 2 and 3 of the males and five scattered setae are present on the dorso-lateral surface of segment 2.

On ensuing segments the dorsal striae are pronounced, first reaching the middle of the dorsum on segment 10, 11, or 12; median sulcus well developed, the notch at its posterior end rather deep but narrow, inconspicuous; serrations of the lower posterior margin of the segments fine, the lower striations little stronger than those on the dorsum.

Preanal scale evenly rounded behind.

Gonopods as shown in figure 4, *b* and *c*.

Male with pleurae of the third segment produced inward; the long, thickened inner margin proceeding obliquely inward from front to back, the posterior corner acute, slightly raised; fourth pleura extending further inward, greatly narrowed and bent sharply away from body into an acute lobe mesad of the pleura of the third segment.

First male legs curving caudad, crassate, nearly as long as the normal legs, covered with clavate setae; second legs as shown in figure 4, *d*; third and fourth legs decreasingly crassate but increasing in length toward that of the ensuing legs; setae of the third legs clavate, those of the fourth legs normal.

Prostemmiulus scaurus spec. nov.

One male (type) and two females, the largest of which lacks the head and at least the first four segments, collected at Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Cordillera Central, Dominican Republic, August 1938.

Diagnosis. Several characters, including the form of the first segment of the male and the presence on it and several ensuing segments

of clavate setae, might be thought to associate this species with *P. iuloides* but the gonopods belie close relationship; greatly enlarged third male legs are not found in other members of the island fauna except the much smaller Haitian *P. claviipes* Loomis which also shows other differences.

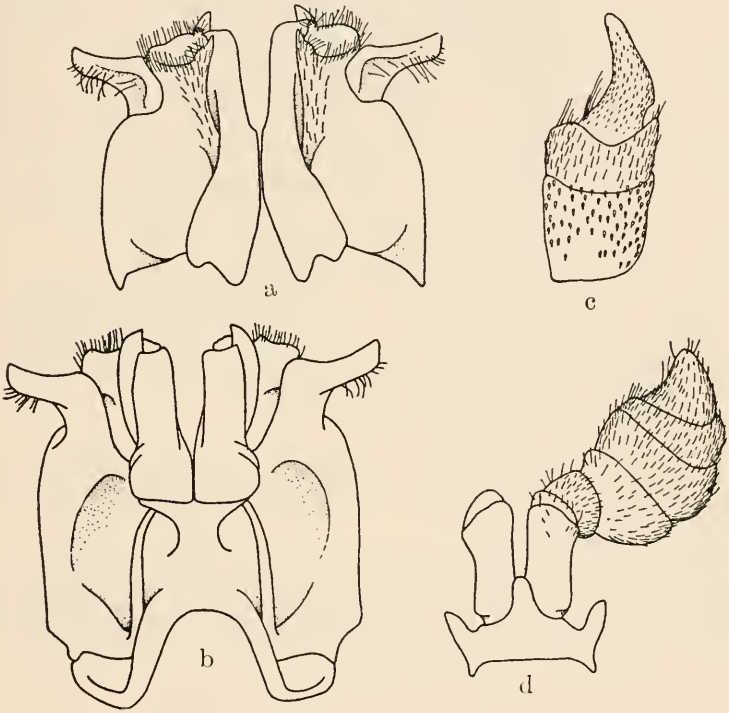

Fig. 5. *Prostemmiulus scaurus*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view; *c*, Second leg of male, anterior view; *d*, Third leg and sternal plate of male.

Description. Body relatively slender and parallel-sided as in *P. iuloides*, resembling a *Paraiulus;* male 25 mm. long, the broken female at least 30 mm. long in life; number of segments 46 to 47.

Color brown in alcohol, a continuous broad light median line the length of the body, the line slightly broader on the anterior portion of each segment, its sides less definite than with most species; at each

pore is a medium sized white spot below which the color becomes lighter brown, finely mottled with white, the region near the legs white.

Head with the eyes unusually small, the posterior ocellus less than half as wide as the antennal socket, the anterior ocellus scarcely half as wide as the posterior one; antennae of usual proportions, with joint 2 longest, the next three joints subequal in length, joint 6 two-thirds as long as joint 5. Mandibulary stipe of male much as in *P. iuloides* but a little narrower, the front more acute; in the female the stipe is squarely truncate in front for a short distance.

First segment with fewer scattered fine dorsal setae than in *P. iuloides* but the lateral striate regions of the two sexes differ as in that species, the surface bearing the secondary striae not at all bent under in the male but somewhat so in the female; the interstrial costae of the male *scaurus* have clavate setae in single series as also are found between the lower striae of the next two segments, there being seven clavately setose interstrial series on segment 3.

Ensuing segments with oblique striae well defined, first approaching the median sulcus on segment 8 or 9; notch at posterior end of median sulcus very small, short, and narrow; serrations of the lower posterior margin faintly obvious only in the pleural region.

Preanal scale evenly rounded behind.

Gonopods as shown in figure 5, *a* and *b*.

First male legs slightly heavier than the fourth pair; second legs as shown in figure 5, *c;* third legs with the four outer joints greatly swollen as shown in figure 5, *d*.

Pleurae of third segment of male produced inward only a little, the inner edge turned slightly away from the body; pleurae of fourth segment extending inward well beyond those of segment 3 and very abruptly turned upward, away from the body, into acute lobes.

Prostemmiulus gracilipes spec. nov.

One male (type) and six females from rain forest near Valle Nuevo, about 6,000 feet elevation, Cordillera Central, Dominican Republic, August 1938.

Diagnosis. The small size of the body with its interrupted light median line, coupled with the form of the pleurae of the third and fourth segments of the male, outwardly distinguish this species, although the gonopods are more definitely characteristic.

Description. Body somewhat subulate, gradually tapering backward from the middle; length 11 to 15 mm; number of segments 38 to

45. Color much as in *P. sulcatus*, the median spot on the prozonites is broader and the lower spot on the sides is as large and distinct as that at each pore.

Fig. 6. *Prostemmiulus gracilipes*. *a*, Second leg of male, anterior view; *b*, Second leg of male, outer, lateral view; *c*, Gonopods, anterior view; *d*, Gonopods posterior view.

Head with the antennae rather short and stout; the second joint not greatly longer than the ensuing three subequal joints; the sixth joint fully two-thirds as long as joint 5; anterior ocellus minute, distinctly less than half the diameter of the posterior ocellus which itself

is unusually small, not equalling half the width of the antennal socket; mandibulary stipe of the male narrower and less inflated than that of the female, both acute in front.

First segment with setae scattered over the surface, those of the male more numerous than of the females but possibly some have been lost from the latter; side of segment of the female, in lateral view, sharply bent under beneath the single margining stria; in the male the surface bearing the secondary striae is not bent under but is continuous in contour with the surface bearing the primary stria.

Ensuing segments with striae quite well defined, first reaching the median line of the dorsum on the anterior portion of the metazonite of segment 14 or 15; median sulcus moderately broad and deep, a short narrow nick in the posterior margin at its end; serrations of the lower margins fine but distinct.

Preanal scale rounded-truncate behind.

Male with the inner margin of the pleurae of segments 2 and 3 much longer than on other segments, rounded; the pleurae of segment 3 not specially produced inward or elevated; each pleura of segment 4 inwardly produced into a parallel-sided lobe with only the margin of the inner, rounded end slightly raised.

First male legs not notably stouter than the third or ensuing pairs; second legs as shown in figure 6, *a* and *b*, the outer joint unusually long and slender.

Gonopods as shown in figure 6, *c* and *d*.

Prostemmiulus tridigitatus spec. nov.

Two males (one the type) and a female from Mt. Quita Espuela, between 1,000 and 3,000 feet elevation, July 1938; in the same month two males and two females collected between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, Dominican Republic.

Diagnosis. The gonopods, with the three finger-like processes at the posterior apex of each inner armature, are the most distinctive character of this species but an outward peculiarity is the faint impression of the dorsal striae and generally their failure to approach close to the median sulcus of the segments.

Description. Body strongly subulate, narrowing sharply from the middle to the very narrow last segment; the larger specimens all about 25 mm. long, the females 2.2 mm. wide and 2.5 mm. high, males not so stout or so noticeably compressed; segments 43 to 47.

Color in alcohol brown with light markings; specimens from type locality with anterior two-thirds of first segment dark, the posterior third and segments 2 and 3 and the anterior portion of the fourth segment very light; in specimens from the other locality these segments are more similar in coloration to those succeeding, the first of which have a white median fascia, wide on the prozonites and narrow on the metazonites, but this becoming very broad on the mid-body segments although even there it is widest on the prozonite and shows through the metazonite of the preceding segment; there is a small white spot near each pore and a still larger white spot farther down the side below which the brown color begins to fade, the lower sides white.

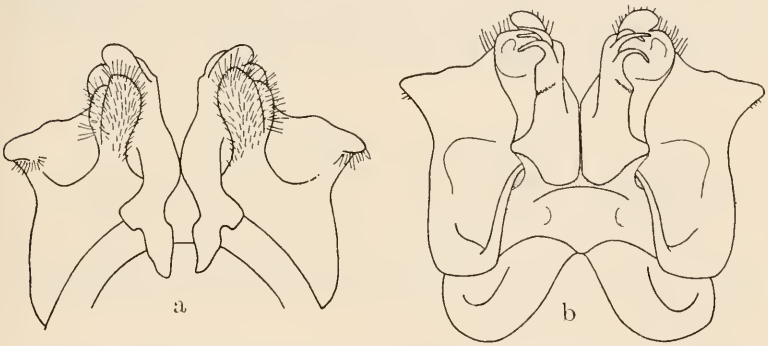

Fig. 7. *Prostemmiulus tridigitatus*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view.

Head with the antennae long and slender; joint 2 longest; joints 3, 4, and 5 subequal in length; joint 6 two-thirds as long as joint 5; ocelli very convex; the posterior one two-thirds the diameter of the antennal socket; the anterior one half the size of the posterior; the female from the type locality has, on one side of the head, a third ocellus the size of the anterior one and mesad of the posterior ocellus; mandibulary stipe of the male rounded-acute in front; a raised rim on all sides, with the inner surface evenly inflated; stipe of female larger, relatively broader and slightly more convex.

First segment with a few scattered hairs on the dorsum; the side of the segment, below the single primary stria, bent under in both sexes, hiding the subventral or secondary stria from lateral view.

On ensuing segments the oblique striae are very fine and weakly impressed and do not extend above the pores until after segment 10 or

even further back, and thereafter four striae, at most, are seen above the pore on either side, the innermost seldom approaching close to the median sulcus even toward the anterior limit of the metazonites; dorsal surface with coarse, longitudinal, slightly undulated aciculations; lower posterior margin of segments with coarse serrations quite remarkable in view of the weak striae.

Preanal scale rounded truncate behind.

Gonopods as shown in figure 7, *a* and *b*.

Second male legs much like those of *P. scaurus*, the outer joint turned forward sharply; third legs normal.

Pleurae of third segment of male scarcely at all produced mesad, the inner posterior corner slightly raised; each pleura of the fourth segment strongly produced inward and forward, the mesial half bent sharply upward, away from the body, into an acute lobe.

Prostemmiulus sulcatus spec. nov.

The single male (type) collected between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

Diagnosis. The color pattern is distinctive if that of the single specimen is typical of the species. The gonopods are of a form not to be confused with any other species although showing relationship to the Haitian *P. heterops* Loomis.

Description. Body subulate, tapering toward the back from in front of the middle of the body; length 20 mm; number of segments 42.

Color generally dark, the usual light median fascia reduced to an elongate spot on the prozonite of each segment but showing through the translucent integument of the metazonite of the preceding segment, a larger white spot at each pore with a smaller, less definite spot between it and the base of the legs.

Head with the eyes small, the anterior ocellus half as large as the posterior one which is much smaller than the antennal socket; antennae with joint 2 longest; joints 3, 4, and 5 subequal; joint 6 over two-thirds as long as joint 5, mandibulary stipe surrounded by a raised rim; the median portion strongly inflated; anterior margin very obliquely truncated, the truncation almost continuous with the lower margin.

First segment with setae sparsely scattered over the surface; a single stria along the anterior margin each side with shorter, less pronounced striae on the sharply bent under, subventral surface.

Oblique striae of ensuing segments well defined, first reaching the

middle of the dorsum at the anterior part of segment 11 or 12; median sulcus broadly and deeply impressed on the posterior part of each metazonite, the notch in the margin at its end shallow and very conspicuous; serrations along the lower posterior margin of the segments weak.

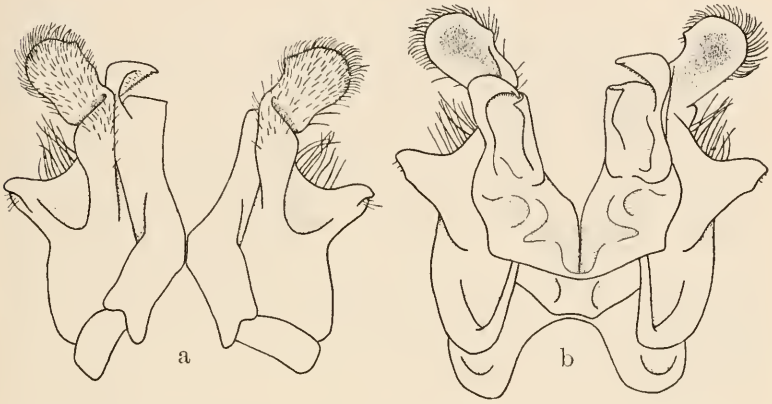

Fig. 8. *Prostemmiulus sulcatus*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view.

Preanal scale with a quite definite truncation at apex, not evenly rounded.

Gonopods as shown in figure 8, *a* and *b*.

First male legs very little stouter than the normal third legs.

Third pleura not produced mesially but inwardly elevated, especially at the posterior corner; fourth pleura produced inward, ending in a broadly rounded, slightly upturned, apex.

Prostemmiulus setosus spec. nov.

A single female from Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Cordillera Central, Dominican Republic, August 1938.

Diagnosis. In this genus, founding of species on female types cannot be justified unless a unique distinguishing character or a peculiar combination of several characters is present. The scattered setae on the dorsum of the above specimen is a character which fully warrants erection of a new species as it is found in no other known member of

the family, the usual arrangements of setae being a single series along the posterior margin of each segment.

Description. Body mostly parallel-sided, the posterior third narrowing slowly to the moderately broad last segment; not conspicuously compressed laterally; length 17 mm; number of segments 46.

Color brown with an interrupted median fascia present as a large white spot on the prozonite but showing through the transparent posterior third of the overlapping metazonite; a tiny white spot at each pore and a larger spot half way to the legs; the color below this spot much lighter brown.

Head with a very short, faint, median sulcus on the crest of the vertex; ocelli greatly differentiated in size, the posterior one half the diameter of the antennal socket, the anterior one minute, only a fourth as broad as the other ocellus; antennae with joint 2 much longer than any other, the subequal joints 3 and 5 next in length with joint 4 slightly shorter than either; antennae widest at apex of joint 5; mandibulary stipe narrowly subtriangular, acute in front, the surface ascending in a flat plane to an acute elevation along the dorsal third; lower margining rim prominent.

First segment with a fine primary stria in front, below which are one or two very fine, short, secondary striae; region above the lower part of the primary stria subrugose with fine longitudinal wrinkles; surface scattered with fine erect setae which are more numerous along the front and back margin than on the central portion.

Ensuing segments with a posterior marginal row of 16 to 22 fine setae and additional setae sparsely scattered over the remainder of the dorsal surface of the metazonites; oblique striae well defined, not reaching the moderately impressed median sulcus until the middle of the body or beyond; posterior half of metazonites coarsely marked with numerous deep longitudinal aciculations; median notch of posterior margin minute, very short and narrow, serrations of margin very small but acute, confined to the area beneath the legs.

Preanal scale almost semicircularly rounded behind.

Prostemmiulus sp.

Eight females, ranging in length from 18 mm. to 45 mm. from El Yunque, Puerto Rico, May 1938.

It is to be regretted that males were missing from this collection, for without them identification is not possible. The specimens appear to belong to a single species, in spite of the great variation in size, and

were only those of intermediate size present they would be considered as *P. compressus* (Karsch). However, since the largest specimens far exceed any other West Indian *Prostemmiulus* in length they cannot be assumed to be *P. compressus* until more is known about that species.

Scoliogmus genus nov.

Diagnosis. Related to *Prostemmiulus* but differing in the following major particulars: the dorsal striae are not straight and oblique but are strongly curved, the inner one or two showing a tendency to meet or cross the median sulcus almost transversely; the stipes of the gnathochilarium have a pronounced outer lobe or flange not found in other genera of the family and the gonopods are generically distinct.

Description. Body of moderate size, cylindric, much like *Paraiulus*, scarcely compressed laterally.

Head with two large, strongly convex ocelli, the anterior one a little smaller than the one behind which is more convex; antennae long and rather slender, the second joint longest; stipes of the gnathochilarium, in the male at least, with a prominent thickened lobe or flange along the outer side.

First segment much as in *Prostemmiulus*.

Ensuing segments with pronounced striae, those on the dorsum strongly sinuously curved except the uppermost one or two which are more nearly curved in a simple segment of a circle and tend to meet or cross the lightly impressed median sulcus at approximately a right angle; pleural sutures closed as in *Prostemmiulus*.

Gonopods terminating in a long, curved arm on either side, which, in repose, remains outside the body.

Anterior legs of the male lacking the strongly clavate setae characteristic of these legs in *Prostemmiulus*.

Type. *S. teres* spec. nov.

Scoliogmus teres spec. nov.

A single male from the Maricao Forest, elevation about 2,500 feet, western Puerto Rico, June 2 and 3, 1938.

Description. Body cylindric, very indefinitely compressed laterally, except on the caudal segments, the proportions much like *Paraiulus*, the posterior end less tapering than usual in *Prostemmiulus;* length 33 mm.; number of segments 49.

Color in alcohol dark brown with yellow and white markings; median

line yellow, continuous from segment 2 to the apex of the last segment; on all but a few of the first and last segments the line is much broader at the anterior margin of each metazonite; prozonites white, in part showing through the transparent posterior portion of the metazonites; in front of each pore and slightly above it is a tiny white spot; pore in a large area maculate with light spots; below the pore the color lightens, becoming almost white ventrally.

Head with the median furrow long, faintly impressed; antennae long and moderately slender; joint 2 longest and as slender as joint 3; joints 3, 4 and 5 decreasing slightly in length; joint 5 over twice as broad at apex as at base but still not as broad as joint 6 which is over two-thirds as long; ocelli large and prominent, the posterior one nearly as broad as the antennal socket and almost hemispherically convex; anterior ocellus considerably more than half as broad as the posterior but not quite as convex; mandibulary stipe broad, rounded in front, strongly inflated, surrounded by a raised rim thickest along the lower margin; gnathochilarium peculiar in having the stipes expanded on the outer side by the presence of a large thickened lobe or flange as shown in figure 9, *a*.

First segment (Fig. 9, *b*) not sharply turned under at the lower angle, showing two secondary striae in lateral view, with a long primary stria above them and, considerably above this, another stria proceeding from the posterior margin half way to the anterior margin.

On ensuing segments the dorsal striae first reach the median sulcus at segment 7 or 8, the striae well defined, not straight and oblique as in *Prostemmiulus* but strongly bent, undulated or merely simply curved, the innermost one or two meeting or crossing the fine, lightly impressed median sulcus at nearly a right angle (Fig. 9, *c*); intervals between the striae with fine longitudinal aciculations; median notch of the posterior margin small, broad, and shallow, inconspicuous; serrations of the lower posterior margins very fine, almost obsolete; caudal segments gradually narrowing and slightly compressed laterally, the last segment wider than in most species of *Prostemmiulus*.

Preanal scale large, broadly rounded behind.

Gonopods as shown in figure 9, *d*, *e*, and *f*, the finely striate, curved, apical arm of each gonopod protruding outside the body and resting against the lower side of segment 7.

First male legs with the two basal joints thin but very broad, much broader than long, the next joint longer and thicker than the corresponding joint of the midbody legs, the three outer joints little heavier than those of the third or ensuing legs but with a comb of fine setae

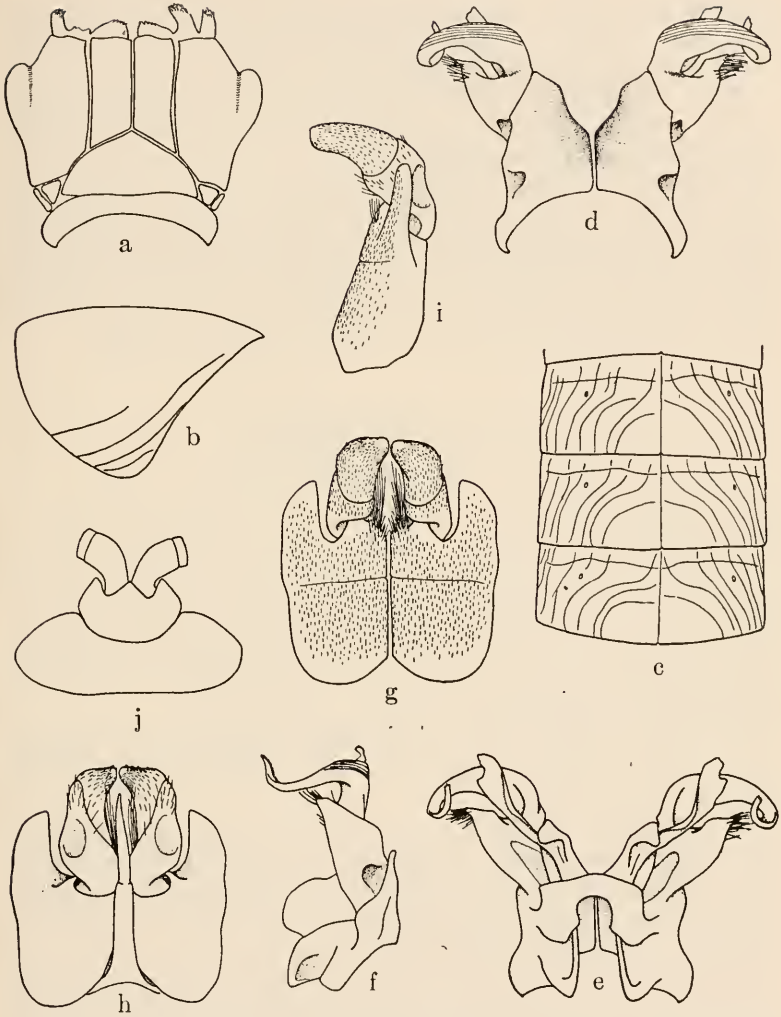

Fig. 9. *Scoliogmus teres*. *a*, Gnathochilarium; *b*, Segment 1, ventrolateral view to show the two subventral striae below the long lateral stria; *c*, Three segments from middle of body, dorsal view; *d*, Gonopods; anterior view; *e*, Gonopods, posterior view; *f*, Gonopods, anterolateral view from slightly above; *g*, *h*, & *i*, Second male legs, anterior, posterior, and lateral views, respectively; *j*, Basal joints of legs and sternal plate of anterior legs of segment 13, male.

beneath the last joint; none of the pregenital legs with the clavate setae usually found in the males of *Prostemmiulus*.

Second male legs as shown in figure 9, *g*, *h*, and *i*.

Third legs slightly smaller than the fourth and ensuing pairs; the sternal plate and basal joints of the anterior pair of legs from a mid-body segment as shown in figure 9, *j*.

Male with the pleura on either side of segment 3 not at all produced inward, in fact not reaching inward as far as the pleura of segment 2, the inner margin broadly rounded and not elevated; pleura of segment 4 produced inward far beyond that of segment 3 into a broad, thickened, inwardly rounded lobe which, if anything, is bent toward the body rather than away from it as is common in *Prostemmiulus*.

EPINANNOLENIDAE

Epinannolene curta spec. nov.

Four males, one the type, and three females from El Yunque, Puerto Rico, May 1938.

Diagnosis. From the shape of the gonopods it appears that this species is much more closely associated with the Cuban *E. biseriatus* Loomis and its Costa Rican and Cocos Island relatives than with any of the species on the intervening island of Hispaniola. It is distinguished from *E. biseriatus* in having three series of ocelli, and definite pits throughout the transverse sulcus of the segments.

Description. Body long and slender, the females longer and stouter than the males; length of largest male 19 mm, largest female 23 mm; number of segments 46 to 57.

Color in alcohol rather light brown with the posterior third or half of the metazonites transparent, allowing the color of the prozonites to show through; on the caudal segments the transparent band is wider than on the segments farther forward; below and in front of each pore the color is darker brown than elsewhere.

Head with 15 to 17 ocelli in three series as shown in figure 10, *a;* clypeal fovea 2–2, labral setae 7–7 or 8–8; mandibulary stipe of male narrower and a little less convex than that of the female and with a higher raised margining rim, anterior end narrowly rounded in both sexes.

First segment as shown in figure 10, *a*, with a fine stria along the front margin below the eye; behind this is a longer stria, its lower half broader and much more deeply impressed than the upper half, the

stria variously curved in different specimens or even on the two sides of the same one; above the long stria one or two shorter but usually strongly impressed, curved, striae proceed forward from the posterior margin.

Ensuing segments with the constriction strongly impressed across the dorsum as well as on the sides, its bottom occupied by a row of pits which are small but distinct on the dorsum and increase materially in size on the ventral half of the body; prozonites and metazonites equally convex, the former brilliantly shining as are the metazonites above the fine lateral striae, each of which originates from

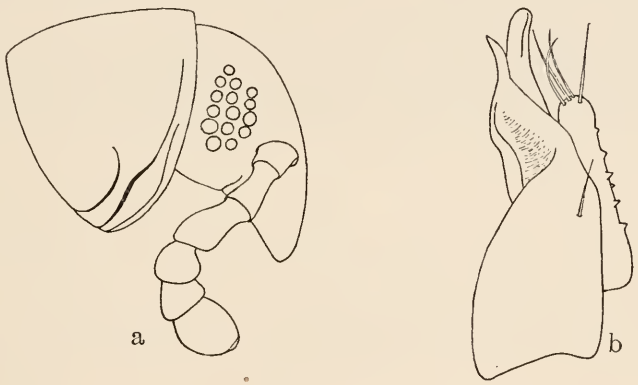

Fig. 10. *Epinannolene curta*. *a*, Head and first segment, lateral view; *b*, Left hand gonopod, anterior view.

the bottom margin of a pit in the constriction and extends back in a downwardly bowed curve; the striae extend fairly well up on the sides of segments 2 and 3 but reach their highest point on segment 4, 5, or 6, after which they suddenly decrease so that behind segment 10 or 11 only one or two very fine striae may be seen close to the base of the legs; at the highest point reached by the striae they are well below the line of the pores which begin at segment 5.

Last segment large and hood-like, the apical portion not in the least produced, the posterior margin continuing in the same direct line throughout its length.

Preanal scale with posterior margin much less rounded than the anterior margin or very faintly angled at middle; lateral processes of moderate size.

Gonopods shown in figure 10, *b*, quite closely resembling those of *E. biseriatus* but several differences are apparent.

Ventral margin of segment 7 raised into a lobe on each side much like that shown in Brolemann's figure for *E. pittieri*[1], the lobes slightly narrower in relation to their height.

SPIROBOLIDAE

Rhinocricus parcus Karsch

Rhinocricus parcus Karsch, Zeits. Naturwiss., Ser. 3, Vol. 6, p. 68, 1881.

One female from Maricao Forest, western Puerto Rico, at about 2,500 feet elevation, June 2 and 3, 1938.

Although the size of this specimen is considerably less than given for the species, it being 64 mm. long, 9 mm. in diameter and having 44 segments, the position of the pores and the scobination of the segments

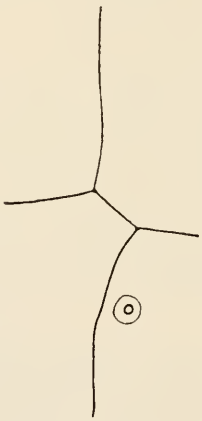

Fig. 11. *Rhinocricus parcus.* Repugnatorial pore and sutures on side of segment from middle of body.

leaves no doubts as to the correctness of identification. The repugnatorial pores all are well removed below the lateral suture and in front of the transverse one; the sutures, clearly indicated by light colored lines in the dark integument, are as indicated in the accompanying figure 11. Scobinae are present on segments 8 to 12 only and are much

[1] Ann. Soc. Ent. Fr., Vol. 72, p. 138, figs. 6, 7, 1903.

broader in proportion to the size of the body than in any other species with which I am familiar, the broadest measuring over 3 mm. each. On segments 7 to 11 the posterior margin, above each scobina of the succeeding segment, is deeply emarginate and the margin is much thicker than elsewhere.

Seventh joint of the antennae with numerous sense cones.

Rhinocricus hispaniolus spec. nov.

The male type and five paratype males and females from Jarabacoa, Dominican Republic, August 2, 1938. Additional specimens also collected in 1938 in the following Dominican localities—Foothills north of Loma Rucilla, 5,000 to 8,000 feet elevation, Cordillera Central, June; Mt. Quita Espuela, 1,000 to 3,000 feet elevation, July; Loma Vieja, southwest of Constanza at about 6,000 feet elevation, Aug. 7–9; Valle Nueva, near Constanza, between 6,000 and 8,000 feet elevation, Aug.; Constanza to Valle Nueva, between 3,000 and 7,000 feet elevation, Aug.

Diagnosis. The unusual gonopods with their curiously formed median plate, are quite different from those of other members of the genus, although Cuban species, such as *R. sagittatus* Loomis and *R. clypeatus* Loomis, show strong tendencies toward similar development. The median plate is quite similar in structure to that in *Leiocricus diversipes* Loomis but other characters exclude the species from that genus.

Description. Body from 40 to 50 mm. long and 3.5 to 4.5 mm. in diameter, the males more slender than the females; number of segments 47 to 50; color in alcohol dark brown, almost black, with lighter mottlings on the sides, the posterior margin of each segment colorless-translucent; head and median area of first segment lighter brown.

Head with 19 to 25 flat, inconspicuous, ocelli in five series forming a rather small rounded group; median sulcus more or less impressed from the back of the vertex to the front of the clypeus; antennae short and stout, the sixth joint densely pubescent in contrast to joint 5 which has only a few hairs at the distal end; sense cones four; cardo of mandibles broad and flat, with a thick raised rim except along the back margin, the anterior margin squarely truncated, the lower anterior corner a right angle or frequently produced into a distinct tooth; gnathochilarium as shown in figure 12, *a*, the lower half of the mentum transversely striate, the lower half of the stipes with several vertical wrinkles.

First segment broadly and evenly rounded on the sides, the raised rim short, present only along the lower anterior-lateral margin.

Second segment with a distinct angular shoulder below the limits of segment 1, the ventral surface concave and coarsely striate.

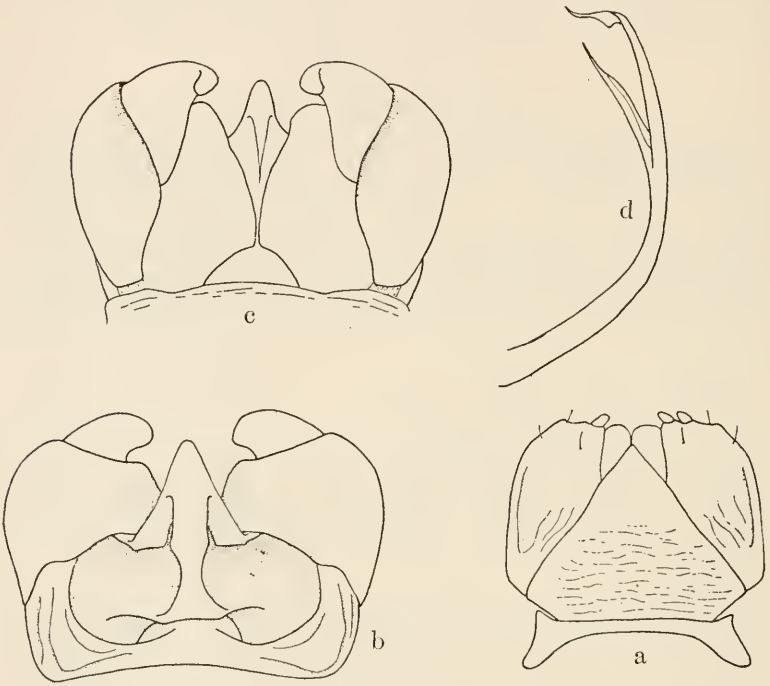

Fig. 12. *Rhinocricus hispaniolus*. *a*, Gnathochilarium; *b*, Gonopods, anterior view; *c*, Gonopods, posterior view; *d*, Apical portion of inner gonopod, same scale as *b* and *c*.

Principal body segments have mid-belt a third longer than the other two belts; the fore-belt usually separated from the mid-belt by a lightly impressed sulcus in front of which the surface is very faintly striate with fine lines; scobinae lacking; beginning on segment 2 the mid- and hind-belts are separated by a strong and abruptly impressed sulcus in full evidence to the penultimate segment on which it is variably impressed, the sulcus usually straight in passing behind the small pores which are somewhat conspicuous from being at the

bottom of a distinct pit; lateral sulcus seldom in evidence at the line of the pores; surface of mid- and hind-belt shining and apparently smooth but close inspection shows tiny fine aciculations; ventral striae entirely beneath the legs in ventral view, coarser and more extensive on the hind-belt than on preceding belts; last segment with apex somewhat produced but not surpassing the anal valves.

Anal valves not strongly convex, the margins appearing a little raised and sometimes set off by a distinct furrow; preanal scale triangular, the posterior margins converging in straight lines to the acutely rounded apex.

Gonopods as shown in figure 12, *b*, *c*, and *d*.

Anterior male legs stouter than those following the gonopods; joint 2 of the second legs enlarged, inwardly flattened, the posterior corner produced into a small rounded lobe; coxae of legs 3 to 7 inclusive produced into thickened conical lobes increasing in size to the seventh legs.

Ventral surface of seventh segment of male slightly raised into a thick transverse crest not excavated in front and scarcely concave for the accommodation of the gonopods.

Rhinocricus arboreus (Saussure)

Spirobolus arboreus Saussure, Linnaea Ent., Vol. 13, p. 331, 1859.

Three females Maricao Forest, western Puerto Rico, June 1938 at 2,500 feet.

Alcimobolus angustipes Loomis

Bull. Mus. Comp. Zool., Vol. 80, No. 1, pp. 57–58, 1936.

Specimens collected in Dominican Republic, July 1938, at Sanchez; Villa Altagracia; and Mt. Diego de Ocampo, Northern range at an elevation between 3,000 and 4,000 feet. Additional specimens from Mt. Is. de Torres, Puerto Plata, in September 1938. In the U. S. National Museum collection of millipeds are three males and a female from Rio San Juan, March 1928.

Included in the above are specimens greatly increasing the size given in the original description, the largest female being 110 mm. long and 13 mm. in diameter, the largest male 85 mm. long and 9 mm. in diameter. In all the males the tips of the gonopods project outside the body cavity, approximating the tips of the coxae of adjacent legs.

Trigoniulus lumbricinus (Gerst.)

Spirobolus lumbricinus Gerstaecker, Gliederthier-fauna Sansibar, p. 516, 1873.

Sanchez and vicinity, Dominican Republic, July 1938.

Microspirobolus marmoratus Silvestri

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 571–572, 1908.

A single female from about 2,500 feet elevation, Maricao Forest, western Puerto Rico, June 2 and 3, 1938, collected with specimens of *M. insularis* Silvestri.

This specimen is referred with some doubt to the present species, although the last segment is typical, and the color, while generally darker, shows light yellow on the dorsum in spots and may be ascribed to age. If this specimen is correctly assigned, it is older and larger than the specimens Silvestri examined, being over 30 mm. long and with 50 instead of 37 or 38 segments. The segments are without any indication of transverse constrictions.

Microspirobolus insularis Silvestri

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 572–573, 1908.

Two males and several females from Maricao Forest, about 2,500 feet elevation, western Puerto Rico, June 2 and 3, 1938.

A male nearly 40 mm. long exceeds by almost 10 mm. the length given by Silvestri, but the other male is smaller and the gonopods of both agree with each other and with Silvestri's figure.

Microspirobolus sigillatus Loomis

Smiths. Misc. Coll., Vol. 89, No. 14, pp. 20–21, 1934.

Three males and three females from Mt. Diego de Ocampo, Northern Range, 3,000 to 4,000 feet elevation, Dominican Republic, July 1938; collected with specimens of *M. signatus*.

Microspirobolus signatus spec. nov.

Two males (1 the type) and two females from Mt. Diego de Ocampo, Northern Range, between 3,000 and 4,000 feet elevation, July 1938, and two other pairs from Villa Altagracia, July 1938, Dominican Republic.

Diagnosis. The color pattern; limitation of the sulcus in the constriction to the dorsum and upper sides of the body; and the slight groove of the anal valves are outward characters distinguishing this species, but final identification must rest, as with many other members of the genus, on the peculiarities of the gonopods.

Description. Length of largest specimen, a female, 28 mm., diameter 2.5 mm.; males slightly shorter and relatively more slender than females, number of segments 40 to 44.

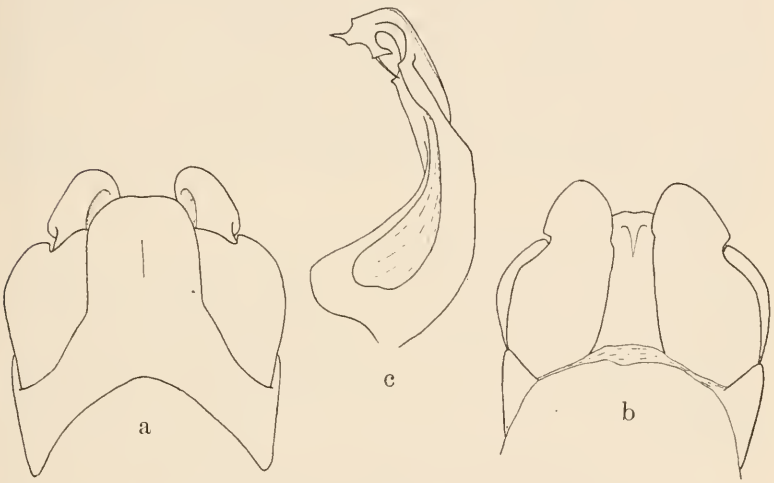

Fig. 13. *Microspirobolus signatus. a*, Gonopods, anterior view; *b*, Gonopods, posterior view; *c*, Inner gonopod, posterior view.

Head rather dark, a little lighter at clypeus; first segment encircled by white band twice as wide along front margin as elsewhere; central area dark brown or black; ensuing segments with a more or less continuous dark median line much the widest at the front of each segment and narrowing to a point at or near the back margin; laterad of this dark triangle, in front of the constriction, the color is dark with variable light mottlings but the constriction itself is narrowly white and behind it the surface is light reddish, becoming even lighter on the posterior segments; last segment with a transverse white spot in front extending from the dark median line to the ventral surface, the remainder of the segment solidly dark, contrasting sharply with the

lighter foregoing segments; anal valves dark above, lighter below and along the margins; preanal scale light.

Vertex of head with fine median furrow; ocelli strongly convex, numbering 28 to 37 in five or six series forming a nearly circular group.

First segment with the sides converging to the narrowly rounded lateral limits; margin with a strong narrow rim extending from behind the eye around to the posterior margin.

Beginning with segment 2 all but the last half dozen segments have a shallow constriction marked by a fine sulcus crossing the dorsum and reaching a short distance below the pore on each side; sides and dorsum dully shining, with numerous length-wise aciculations; ventral striae fine, extending farther up the side in front of the constriction than behind it but not closely approaching the small pore.

Last segment with a slightly produced, rounded apex not surpassing the anal valves which are evenly inflated but meet in a narrower, shallower groove than is usual; preanal scale large, the apex evenly rounded.

Gonopods as shown in figure 13, *a*, *b*, and *c*.

Legs 3, 4, and 5 of the male with the coxae apically depressed, probably indicating the presence of an inflated pad in life; a similar depression on the ventral face of the second joint of the legs beginning with the third pair and extending to the caudal pair.

Ventral crest of segment 7 of the male high and short and sharply rolled back, its anterior face more deeply and narrowly concaved than usual.

Microspirobolus tenuipes spec. nov.

Thirteen specimens of both sexes, including the male type, from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

Diagnosis. The shape of the very thin, compressed gonopods offers the most satisfactory character for distinguishing this species from other members of the genus.

Description. Largest male, the type, 30 mm. long and 2.3 mm. in diameter, the females stouter, one of the same length being almost 3 mm. in diameter; number of segments 40 to 46.

Color in alcohol dark slate gray, at times with a slight tinge of deep red; a broad median spot of light color on the forebelt of each segment showing somewhat through the foregoing segment, especially its narrow, colorless, translucent posterior border; immediately behind the transverse constriction, a short distance on either side of the

middle of the dorsum, is a small elongate light spot either transverse or slightly inclined backward from the outer end; in younger specimens the light colored areas are larger but with less distinct limits.

Head with median furrow of vertex short and faint; eyes the size of the antennal socket or smaller, the ocelli relatively few, small and not distinctly elevated above surface of head, numbering 21 to 23 in five series.

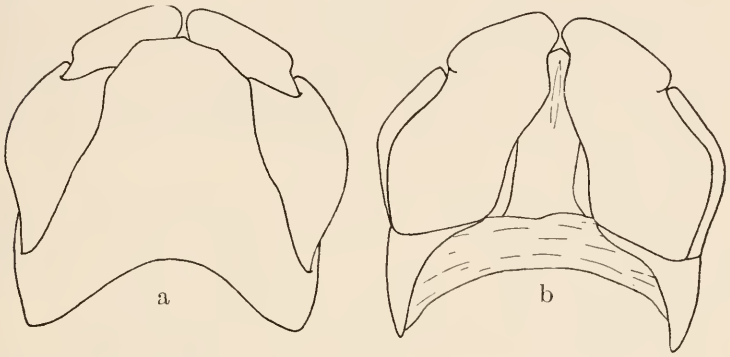

Fig. 14. *Microspirobolus tenuipes*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view.

First segment narrowing on each side to the rounded-truncate lateral limits and with a raised rim extending from behind the eye around to the posterior margin, the front margin below the eye straight or only slightly emarginate. Ensuing segments with a strong sulcus marking the transverse constriction from segment 2 to the last five segments where the constriction vanishes; pores of moderate size surrounded by a small impressed ring; dorsal surface of segments smooth and shining; ventral striae fine and confined to the lower surfaces except on a few of the anterior segments where short striae immediately behind the transverse sulcus exceed the tips of the legs but do not approach close to the line of pores.

Last segment produced to an acute point not surpassing the valves, the thick margins of which meet in a deep groove; preanal scale large, subtriangular, the sides straight to the rounded-acute apex.

Gonopods very thin, their anterior and posterior aspect shown in figure 14, *a* and *b*.

Ventral surface of segment 7 of the male raised at middle into a very thin, backwardly curved, lip-like ridge, broad and low on either side.

Males with the second joint of all but the first two pairs of legs with a depression along the ventral side indicating the presence of an inflated pad in the living animals, the legs normal in other particulars.

Microspirobolus pullus spec. nov.

Four males (1 the type) and a female from between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

Diagnosis. The dark color, combined with the medium body size, and the shape of the preanal scale, are external characters distinguishing this species but, as usual, the gonopods present the best differences.

Description. Largest specimen, a female, 26 mm. long and 2.5 mm. in diameter, the largest male the same length but only 2 mm. in diameter; number of segments 39 to 43.

Color in alcohol generally very dark brown, almost black; head rather light brown; the eyes black; the first segment with a broad anterior band of light brown, the posterior margin and that of the other segments narrowly light translucent amber; last segment, preanal scale and anal valves dark; legs and antennae light reddish.

Vertex and front of head evenly convex and shining, entirely smooth or with only a fine short sulcus on the vertex; eyes composed of about 26 ocelli in a four-sided or sub-triangular group of five series, the individual ocelli convexly raised.

First segment with lateral limits short, obliquely truncated, the anterior corner forming a right angle or less, posterior corner much more obtuse; front border slightly emarginate below the eye and with a broad rim extending around to the posterior corner; just above the posterior corner one or two fine short striae usually proceed forward from the back margin.

Beginning with segment 2 the segments of the anterior half of the body have a strong constriction marked by a sharply impressed sulcus in and behind which rudiments of the ventral striae, decreasing in length, reach to the pores or slightly above them; on the posterior half of the body the constriction is evident on all but the last half dozen segments but is not marked on the dorsum by an impressed sulcus and the ventral striae are restricted to the lower sides of the body, adjacent to the legs; surface of segments smooth and shining; pores of medium size.

Last segment with apex slightly produced, sub-angular, but not surpassing the anal valves. Valves strongly shining and moderately convex, not margined. Preanal scale short, three times as broad as

long; in four specimens, including the type, it is shaped as shown in figure 15, *a;* in the other specimen it is more definitely triangular.

Gonopods as shown in figure 15, *b*, *c*, and *d*.

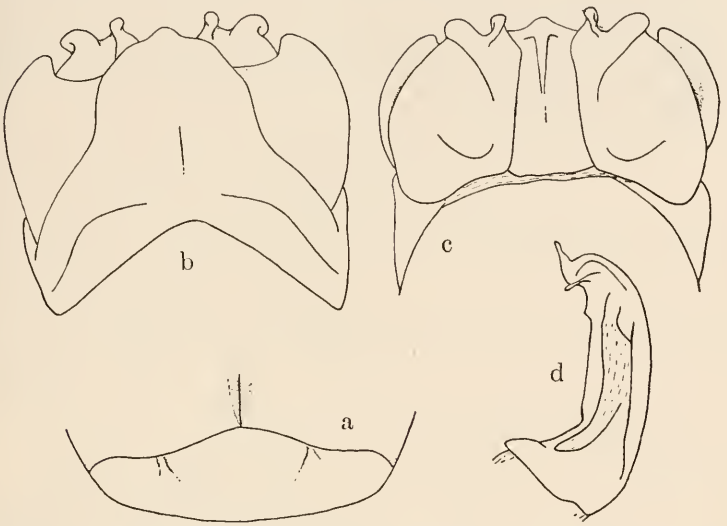

Fig. 15. *Microspirobolus pullus*. *a*, Preanal scale; *b*, Gonopods, anterior view; *c*, Gonopods, posterior view; *d*, Inner gonopod, posterior view.

Male legs 3 to 7 with coxae slightly swollen at apex but without distinct lobes; other joints normal.

Ventral surface of seventh segment of male raised into a transverse ridge, high and thin at middle, the sides lower and thicker.

Microspirobolus instratus spec. nov.

One male (type) and four females collected with *M. pullus* between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

Diagnosis. This is the largest member of the genus thus far discovered in the West Indies. Its color pattern is distinctive, as also are its gonopods.

Description. Largest female 46 mm. long, 3.5 mm. in diameter and with 53 segments; male 34 mm. long, 2.3 mm. in diameter and with 46 segments, thus the males are slightly more slender than the females.

In alcohol the head is dark brown with the clypeal region a little lighter; segment 1 dark brown, nearly black, surrounded by a narrow light translucent border; ensuing segments with forebelt nearly white at the front of the dorsum where it is covered by the preceding segment, the hindbelt narrowly translucent white behind on the dorsum, the light color of both belts broadening in descending and confluent at the base of the legs, the intervening area on the dorsum and sides dark brown, nearly black.

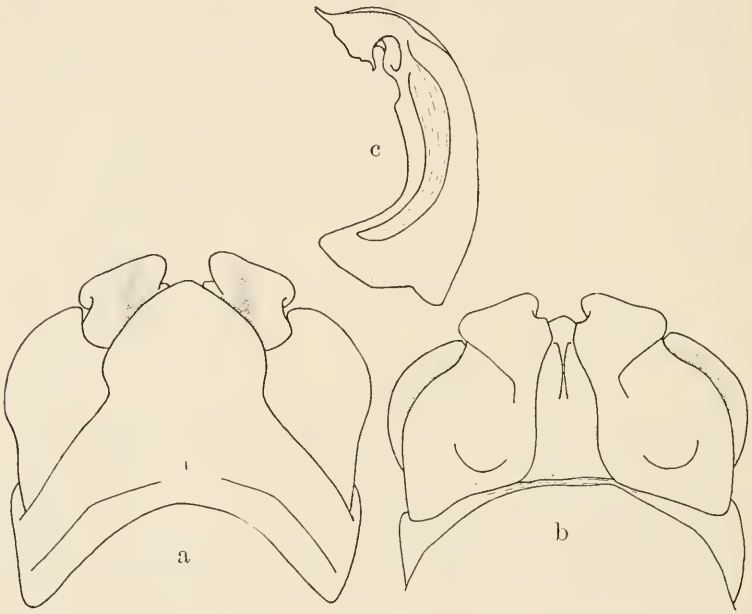

Fig. 16. *Microspirobolus instratus*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view; *c*, Inner gonopod, posterior view.

Head with a short, deeply impressed sulcus on the vertex and a smaller one on the front below the line of the antennae; eyes large, composed of definitely convex ocelli in five or six series, those of the type containing ocelli as follows: 4, 6, 7, 7, 7–5, 6, 7, 6, 5 for the two sides of the head, the largest female having ocelli 2, 6, 7, 7, 7, 6–3, 6, 7, 8, 7, 6.

First segment with sides converging to the rather narrow and sharply rounded lateral margin; front margin slightly emarginate

below the eye and bordered by a fine rim around to near the back margin; posterior margin with several fine striae proceeding forward a short distance just above the lateral limits.

Ensuing segments with a strong constriction marked by a sharply impressed sulcus crossing the dorsum of all but a few of the last segments; ventral striae much as in *M. pullus*, reaching the line of the pores or above on the anterior segments; pores small.

Last segment slightly produced into a rather acute apex which does not surpass the valves; preanal scale quite large, sub-elliptic, the posterior margin more broadly rounded than angular.

Gonopods as shown in figure 16, *a*, *b*, and *c*.

Male legs 3, 4, and 5 with the coxal joints slightly inflated at apex, the next joint slightly inflated along the ventral side, the legs normal in other particulars.

Ventral surface of seventh male segment raised in the customary ridge, the median portion rather high and thin, the sides lower and broader.

STRONGYLOSOMIDAE

Orthomorpha coarctata (Saussure)

Polydesmus coarctatus Saussure, Mem. Myr. Mex., p. 297, 1860.

Specimens of this tropicopolitan species collected in the following localities of the Dominican Republic in 1938: Villa Altagracia; Santiago; Sanchez and vincinity; Puerto Plata; Monte Cristi.

CHELODESMIDAE

Achromoporus heteromus spec. nov.

Three males (1 the type) and a female from Sanchez and vicinity, Dominican Republic, July 1938.

Diagnosis. The gonopods resemble those of *A. cuneryensis* Loomis but are more slender; the dark color of the dorsum is more extensive than in the four other species; the difference in size of the poriferous and non-poriferous keels, especially in the males, is peculiar and suggested the specific name.

Description. Length 23 to 28 mm., the females more convex and robust than the males and with lateral keels smaller; males with sides scarcely narrowing after the third or fourth segment, almost parallel.

Head with vertex and front brown to the clypeal region; first seg-

ment dark brown with a white spot at middle along the front margin, a white band along the posterior margin, including the lateral angles, widest at the middle where it approaches, but does not join, the anterior spot; on the ensuing three segments the keels are dark brown except for the narrowly white outer and posterior margin including the posterior corner, the remainder of the dorsum white; on the other non-poriferous metazonites the keel is dark brown except for an area at the posterior corner smaller than that on segments 2, 3, and 4; poriferous metazonites wholly white above; sides below the keels of all segments dark brown; last segment brown on the sides; anal valves brown, the scale white; outer joints of legs and antennae pink.

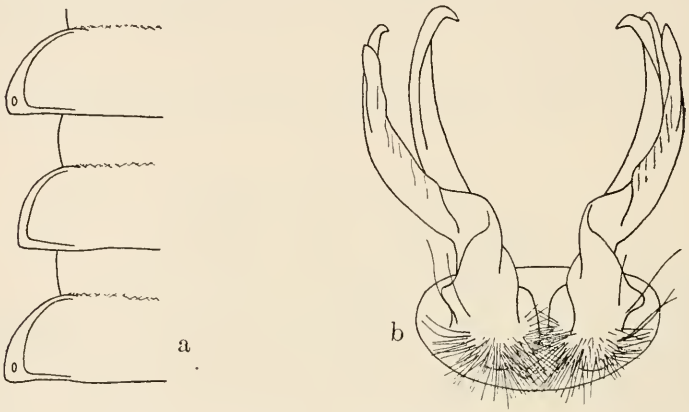

Fig. 17. *Achromoporus heteromus*. *a*, Segments 10 to 12, left hand half from above; *b*, Gonopods.

Surface of segments smooth and shining, the keels, especially the non-poriferous ones of the males, sometimes with several small faint tubercles, the one nearest the posterior corner most evident.

Poriferous keels of male broader than those lacking pores, as shown in figure 17, *a;* the same condition exists in the female but with the much smaller keels it is less striking; in the other species this condition is lacking or only faintly evident.

Preanal scale triangular, much as in *A. enneryensis*, the tip not noticeably prolonged.

Gonopods as shown in figure 17, *b*.

Coxae of second legs not elevated in the female but with a small conic corner in the male; third male legs with the sternum depressed

at middle but without special tubercles either side; male legs 3 to 7 with third joint indistinctly swollen on the under side as in *A. ennerycnsis.*

Lasiomazus genus nov.

Diagnosis. Considering the gonopods, the position of this genus appears closest to the Haitian *Achromoporus* Loomis rather than to any other American genus but even so the relationship is remote; the outer gonopods are more sharply bent and their two branches more diverse in size and shape, and the inner gonopods are unusually expanded; none of the legs or sterna has specialized swellings but both are remarkable in being abundantly decked with curved hairs.

Description. Body over 25 mm. in length, broadest at segments 1 to 3; dorsum smooth and shining, not greatly convex, the rather narrow lateral keels entirely above the middle of the body; pore formula normal.

Head deeply sulcate on vertex with two closely placed erect setae on each side of the furrow in front; surface in front of the antennae sparsely hispid; antennae moderately long and slender, joint 2 longest and almost glabrous; joints 3 to 6 nearly as long, subequal, much more pubescent, the density of the pubescence increasing on each succeeding joint.

First segment semicircular, with hind margin somewhat emarginate at middle, posterior corners slightly produced backward.

Segments 3 to 5 with a tiny tooth on each broadly rounded anterior corner; posterior corners of these and succeeding segments not caudally produced until after segment 15, the corners of segment 18 most produced, those of segment 19 very much smaller and scarcely exceeding the posterior margin; lateral keels narrow, rather thick, continuous with the dorsum and projecting from high above the middle of the body, the outer margin with a sharply defined rim which is slightly thickened around the pores, the pores opening obliquely outward and upward.

Last segment quite long and narrow, the slender apex scarcely deflexed.

Anal valves with rather thin margins strongly elevated; preanal scale large, triangular or angularly rounded behind.

Gonopods as shown in figure 18.

Sterna throughout body broad and densely beset with caudally curved hairs; similar hairs are present on the ventral surface of the joints of the legs; the legs and sterna in front of the gonopods slightly

stouter and with hairs longer and more dense than elsewhere, otherwise unmodified.

Type. *L. concolor* spec. nov.

Lasiomazus concolor spec. nov.

Male type and another male from Loma Vieja, near Constanza, about 6,000 feet elevation, Cordillera Central, Dominican Republic, Aug. 7 to 9, 1938.

Characters not given in the generic description are as follows: Length 26 to 28 mm., width 3.1 to 3.4 mm.; body widest at segments 1 to 3, narrowing gradually thereafter; surface of segments smooth and

Fig. 18. *Lasiomazus concolor.* Gonopods.

shining, some of those at middle of body with a very shallow, indefinite transverse median depression; non-poriferous segments 8, 11 and 14 are slightly narrower than the adjacent poriferous ones; body colorless in alcohol except the light red antennae.

Legs throughout body with joints 1 to 4 nearly glabrous above, densely pubescent or hispid below; joints 5 and 6 completely hispid; the broad, hispid, sterna of each segment separated by a short glabrous space; sternum of the seventh male legs strongly depressed in contrast to the sternum of the sixth and foregoing legs; sternum of the pair of legs following the gonopods short and vertical.

Hypselodesmus genus nov.

Diagnosis. The large, thin, ascending lateral keels of the segments, with a tooth at the anterior corner of all but those at the ends of the body; the indefinite but obvious transverse depression of the segments followed by a submarginal series of tubercles; and the structure of the gonopods show the remote association of this genus with other members of the family in the West Indies.

Description. Body of moderate size; the sides nearly parallel; color of the poriferous segments somewhat different from those lacking pores.

Head with a strong sulcus on the vertex, on each side of which are two erect, closely placed setae; antennae of moderate length, joints 2 to 6 inclusive of equal length with the inner joints almost as abundantly pubescent as joint 6; surface in front of the antennae with a few scattered, erect setae.

First segment short, subelliptic, the median portion of the posterior border slightly emarginate, the outer portion each side extending obliquely outward and forward to the acute corner.

Succeeding segments with the dorsum only slightly convex and, from segment 3 or 4 caudad, transversely crossed at middle by a broad, shallow, indefinite but obvious depression, behind which, close to the posterior margin, is a series of eight to ten small faint tubercles most distinct on the posterior half of the body; in front of the depression is a series of four to six less apparent tubercles; lateral keels rising from far above the center of the body and strongly ascending so that their outer margins are higher than the middle of the dorsum; the keels are thin, especially those without pores, and are unusually large, each extending outward a distance almost equal to the width of the dorsum itself, the raised rim along the three free margins strong; pores opening obliquely outward from the bottom of an elongate oval depression in the additionally thickened rim of the usual segments; from segment 2 to segment 15 or 16 a small acute tooth is present at the broadly rounded anterior corner of each keel; anterior segments with the posterior corners not surpassing the back margin but at segment 6 or 7 the corners begin to be acutely produced and this increases to segment 17 where the corners are very large and conspicuous, the corners on segments 18 and 19 reduced, those of segment 19 very small, hardly a third as large as those of segment 18; segments 3 and 4 with a fine bowed ridge low on each side just above the base of the legs, faint indications of a similar ridge present on segments 2 and 5 also.

Last segment quite long, with the produced apex slightly deflexed. Anal valves rugose, the rather thick raised margins smooth and shining; preanal scale a little broader than long, almost evenly rounded behind from side to side.

Gonopods quite simple, each consisting of a distally slender sigmoid flexure curving out and around behind a short, stout, subcylindrical inner joint.

Second male legs with large seminal tubercles on the coxae; other legs and sterna without special modifications, the legs long and slender, far exceeding the sides of the body, joint 3 longest but almost equalled by the last joint; each sternum with six to ten erect setae on either side of the middle.

Type. *H. bicolor* spec. nov.

Hypselodesmus bicolor spec. nov.

Three mature males, including the type, and two immature specimens from between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

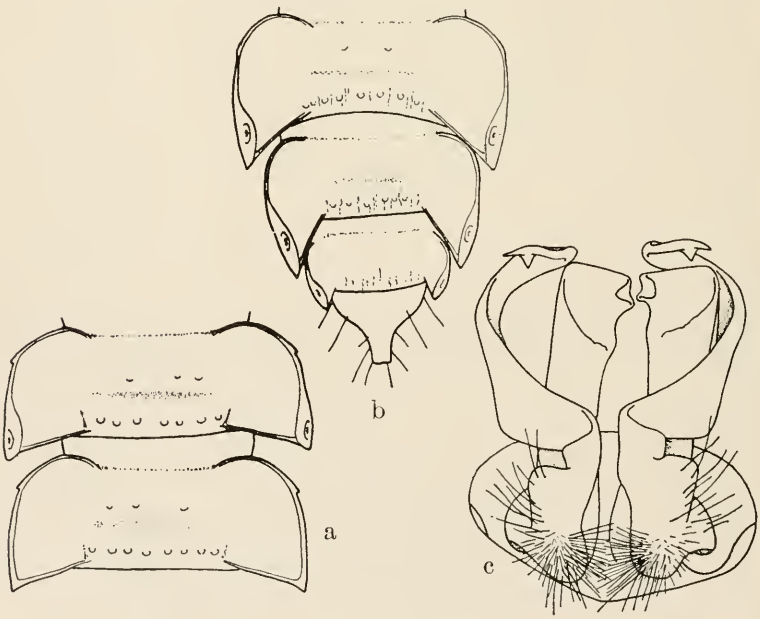

Fig. 19. *Hypselodesmus bicolor*. *a*, Segments 10 and 11, dorsal view; *b*, Segments 17 to 20, dorsal view; *c*, Gonopods.

Description. Length 29 mm, width 4 mm; body widest at segments 1 to 3.

Color dark brown except at the posterior corner of each keel which is white, the area of white being much larger and more intense on the poriferous segments than on those without pores.

Lateral keels large, as shown in figure 19, *a*, those at the posterior end of the body as shown in figure 19, *b*.

Gonopods as shown in figure 19, *c*.

Seminal duct opening from the very obliquely truncated inner face of a long cylindrical erect process rising from each coxa of the second legs.

Other characters are given in the generic description.

Cyrtaphe domingensis spec. nov.

Many specimens of both sexes, including the male type, from between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, July 1938, and other specimens from Mt. Is. de Torres, Puerto Plata, Dominican Republic, Sept. 1938.

Diagnosis. The shape of the gonopods definitely associates this species with *C. continuata* Loomis but the coloration of the body is different and there is less similarity in pattern between the poriferous and nonporiferous segments. The sterna between the third and fourth pair of legs, in the male, are without special swellings.

Description. Length 30 to 33 mm, females with the body thicker and the dorsum more convex than in the males and with the posterior corner of the keels less acute.

In alcohol the head is dark brown except in the clypeal region which is yellowish; first segment encircled by a white margin most extensive at the lateral angles but also somewhat broadened at the middle of the front and back margin; on ensuing segments the prozonite is brown with a large white spot at middle; metazonites on the non-poriferous segments dark brown with only the outer margin of the lateral keels white; poriferous metazonites of fully colored specimens lighter brown with the keels wholly white; in specimens not in full color segments 2, 3, and 4 have a broad continuous median band and ensuing poriferous metazonites may be white with only a dilute brown spot on each side of the dorsum in front; last segment brown except at the middle in front and at the tip.

First segment evenly rounded in front from side to side, the posterior margin medianly emarginate, lateral angles acute.

Segments 3 and 4 sometimes with a minute inconspicuous tooth on the rounded anterior corner of the keels.

Surface of segments smooth and shining except that the keels from segment 2 or 3 to segment 17 or 18 usually have two or three small, low, indistinct tubercles near the base.

Fig. 20. *Cyrtaphe domingensis*. Gonopods.

Anal valves resembling those of *C. alternata* Loomis.

Gonopods as shown in figure 20.

Second male legs with the inner corner of the coxae rounded, not produced. Third sternum little narrower than in the female, lacking definite swellings as also does the fourth sternum; in general the sterna of the males are considerably more hispid than those of the females.

Ricodesmus stejnegeri Chamberlin

Three males, collected at about 2,500 feet elevation Maricao Forest, western Puerto Rico, June 2 and 3, 1938; many specimens of both sexes from El Yunque, Puerto Rico, May 1938.

A large female measure 30 mm long.

Podiscodesmus genus nov.

Diagnosis. This genus seems more closely affiliated to *Antillodesmus* Chamberlin than to other known members of the West Indian fauna

but the small gonopods, while of somewhat similar form, distinguish it as also does the ridge on the side of the anterior segments immediately above the base of the legs.

Description. Body of intermediate size, with the dorsum strongly convex and the lateral keels projecting but a short distance from the sides; body widest at segments 1 and 2, the next three or four segments gradually narrowing, followed by poriferous segments which are uniformly wider than those lacking pores; poriferous segments no different in color from the others; segments smooth above except for slight rugulosity behind near the base of the keel.

Head with a pronounced median sulcus; antennae moderately long, joints 2 to 6 subequal in length with pubescence gradually increasing to joint 6.

First segment of semi-circular form as common in the family, the posterior border emarginate along the middle.

Ensuing segments with lateral keels projecting from above the middle of body, not following the descent of the dorsum but tending to rise to the horizontal; anterior segments lacking tooth at the front corner of the keels; posterior corner of the keels, to near the back end of the body, not produced backward as they are so distinctly in *Antillodesmus*, but those lacking pores sharper than where pores are present, the callus rounding the angle; posterior corners of segments 17 to 19 a little produced, those of segment 18 strongest, the keel on each side of segment 19 reduced to a small tooth projecting out and back from near the hind margin but not exceeding it; pore formula normal; lower sides of segments 3 to 11 with a sharply defined elevation immediately above the base of the legs, beginning as a sharp tooth on segment 3 and thereafter developing into a downwardly bowed ridge which later is reduced to a small tubercle near segment 11 before disappearing. In *Antillodesmus* this ridge is replaced by an indefinite, broad, low swelling with a few tiny granules scattered on the surface.

Anal valves rugulose, the raised margins smooth and shining; preanal scale quite large; rounded, rather than angular, behind.

Gonopods unusually small, straight and slender, their tips scarcely reaching the posterior edge of the sternum of the seventh legs, the basal joint not projecting outside the segmental aperture which is narrower than adjacent sterna.

Legs with joint 3 surpassing the others in length; a single long setae on the under side of joints 1 and 2, lacking from joints 3 and 4; sterna broad, low, glabrous; pregenital legs and sterna like the postgenital ones.

Type. *P. carinatus* spec. nov.

PODISCODESMUS CARINATUS spec. nov.

Two males, one the type, from Sanchez and vicinity, Dominican Republic, July 1938.

Length 25 mm, width 3.5.

In alcohol the head is dark brown gradually whitening at the labral region; antennae with basal joint white, the others gradually deepening in color to dark brown; legs entirely white; first segment reddish brown, the back margin lighter brown, widest at middle, lateral angles white; lateral keels of segments 2 to 4 white, thereafter the light color

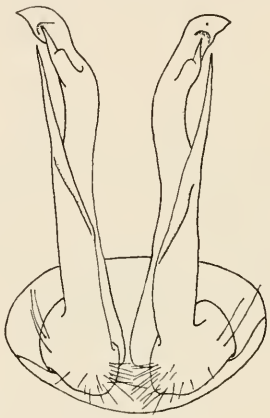

Fig. 21. *Podiscodesmus carinatus.* Gonopods.

gradually becomes more restricted to the posterior corner of the keels, the remainder of the dorsal surface reddish brown with a broad area of light brown (possibly white in life) along the middle of the posterior margin; last segment light reddish brown in front; white at the apex.

Head with a median sulcus at the bottom of a more general depression of the surface; front below the antennae sparsely beset with erect setae.

On either side of segment 3 just above the base of the legs an acute tooth projects caudo-laterad, its free apex equalling the posterior margin; on the next three segments this tooth is replaced by a downwardly bowed longitudinal ridge, largest on segment 6 after which it gradually lessens in size, becomes a small tubercle and finally vanishes at segment 11 or 12; pores opening obliquely outward from a large, elongate callus or thickening of the marginal rim.

Last segment quite long, the slightly deflexed apex rather suddenly constricted.

Gonopods as shown in figure 21.

Craterodesmus genus nov.

Diagnosis. This is an unusually stout-bodied genus with no close relatives known in the West Indian fauna. The swollen preanal scale probably is a generic character and of diagnostic value but most important are the gonopods which are notably different from other recognized genera.

Description. Size large, body stout and convex, much like *Fontaria* but the lateral keels are narrower and on all but the most anterior and posterior segments are well separated from each other; surface shining,

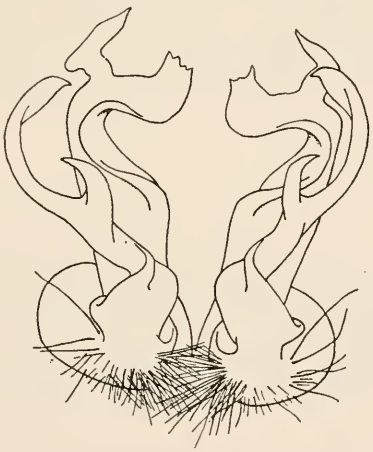

Fig. 22. *Craterodesmus ovatus.* Gonopods.

almost smooth except for a few fine wrinkles and two transverse rows of what appear to be folicles on the keels and adjacent dorsum; poriferous metazonites almost colorless, the non-poriferous metazonites mostly dark brown with lighter margins.

Head with a strongly impressed furrow across the vertex and a pair of erect setae on each side opposite its middle; surface in front of the antennae sparsely hispid; antennae slender and moderately long, joint 2 longest, the next four joints of subequal length; joint 6 slightly broader distally than the other joints.

First segment narrowly transversely elliptic with the back margin broadly concave at middle; lateral angles acute with front and back margins bordered by a raised rim for over half way to the middle of the dorsum.

Ensuing several segments with lateral keels overlapping slightly, followed by segments where the keels are definitely separated but on the last few segments some overlapping occurs; anterior corner of segments without a tooth, the posterior corners not produced backward except moderately so on the posterior segments; segment 19 with the lateral keels scarcely indicated, the posterior angles tiny; pores in normal arrangement, opening almost vertically from a gradually much expanded and flattened posterior part of the margining rim; anterior spiracle on each segment preceded by an especially high, thin crest, in outline almost an equilateral triangle.

Last segment broad at base, short, rapidly narrowing to the short apex which is not deflexed.

Preanal scale large, inflated behind in both sexes.

Sterna broad and low, separated by an impressed line only near the sides.

Type. *C. oratus* spec. nov.

Craterodesmus ovatus spec. nov.

Two males, one the type, and three females from between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, and five females from between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July, 1938.

Description. Largest male 35 mm long and 6 mm wide; largest female 42 mm long and 8 mm wide; the males a little less convex than the females.

Head dark brown on the vertex and in a narrow median line extending between the antennae to the labrum where it broadens slightly; sides of head, antennae, legs and ventral surface of body uncolored; first segment margined with white, broadening in front and back at the middle, inner area moderately dark brown; next three segments with a large dark brown spot on either side partly on the dorsum and partly on the keel, the two spots joined by a lighter band of brown suffusing the junction of the zonites, remainder of segment white; on ensuing prozonites there is a small light brown spot below the line of the keels and a larger darker spot above it; poriferous metazonites almost colorless; those without pores colorless along the back

margin and up the outer margin of the keel, the posterior band widest at the median line; remainder of zonite dark brown on the sides, lighter toward the middle; last segment with apex and a spot on each side in front light brown.

In addition to the structural characters given in the generic description it may be noted that the anal valves are slightly coriaceous, with thick, high, shining margins; preanal scale transversely oval in outline, the surface low in front adjacent to the last segment but thereafter suddenly inflated, the swollen posterior face of which bears the customary two setae widely separated.

Near the legs the anterior spiracle is definitely larger than the posterior one and is immediately preceded by a short, thin, high, angular crest absent from the posterior spiracle.

Gonopods large and conspicuous, shaped as shown in figure 22.

Third joint of legs immediately before and after the gonopods with a slight bend or umbo beneath; sterna of male legs 5 to 7 broadly depressed at middle to the level of the posterior margin of the segment, apparently for the reception of the gonopods.

Biaporus genus nov.

Diagnosis. Instantly recognized by the pore formula which is unique in the family if not also in the entire order.

Description. Body of moderate length, rather slender; females parellel-sided, males similar to females in width to segments 15, 16, and 17 which are definitely wider than the foregoing segments and more depressed; lateral keels narrow as compared to most other members of the family, thick at base and projecting only a little way from high above the middle of the body and continuous in contour with the smooth, quite convex dorsum.

Head with furrow of vertex long and strongly impressed; one or two erect setae on either side of it in front; surface below antennae rather sparsely hispid; antennae of moderate length, the second joint longest, sparsely pubescent, the pubescence increasing on succeeding joints.

First segment smaller than in many genera of the family; semicircular; the back margin almost straight across, only faintly emarginate at middle.

Segments 2 to 5 with anterior corners of the keels abruptly rounded and each with a tiny tooth; succeeding keels more broadly rounded at the anterior corner and toothless; posterior corners of keels almost right angles, first produced backward on segment 16 but even on segment 18,

where the angles are more produced, they are short and not very acute, those of segment 19 much smaller but relatively more acute, the whole segment much narrower than segment 18; last segment short, with a series of four erect setae across middle and two others at base of the apex which is short and slightly deflexed; pores small, opening obliquely outward from a depression in the somewhat expanded rim of the keel close to the posterior angle on segments 5, 7 to 13, and 15 to 19, thus segments 6 and 14 are poreless.

Anal valves with rather thin and not greatly elevated margins, preanal scale large, subtriangular, the apex slightly produced as in several species of *Achromoporus* Loomis; two setae in the margin adjacent to the apex.

Legs with joint 3 definitely longer than any other joint.

Gonopods as shown in figure 23.

Type. *B. montanus* spec. nov.

Biaporus montanus spec. nov.

A male (type) and a female from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Cordillera Central, Dominican Republic, June 1938; another female from the mountains north of Loma Rucilla between 5,000 and 8,000 feet elevation the same month.

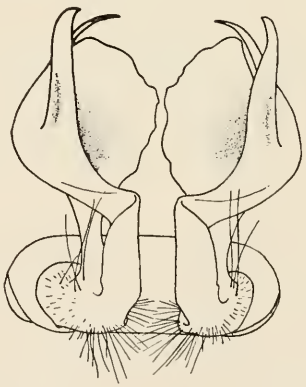

Fig. 23. *Biaporus montanus*. Gonopods.

The following characters were not mentioned in the generic description. Length 22 to 24 mm, width 2.7 to 3 mm; color apparently white or nearly so in life, very light brown in alcohol; surface of body smooth

and shining; anal valves slightly coriaceous with the raised margins smooth and shining; preanal scale smooth; male legs in front of the gonopods stouter than those following and with the upper surface of the second joints more swollen, the sterna and ventral surface of these legs sparsely beset with long erect hairs, the other legs and sterna and all those of the females with almost no setae, those present being much smaller than the anterior ones of the male.

Synecheporus genus nov.

Diagnosis. Insofar as I am aware no other member of the Chelodesmidae has as continuous a pore formula as the present genus, in fact one of the most constant characters of the family is the normal, discontinuous pore formula. Hence, it is remarkable to find two genera, the present one and the foregoing in the same region, both exhibiting departures from the usual formula.

Description. Body of moderate size, over 20 mm long; widest at segments 16, 17, and 18; males similar to females in size and shape; dorsum smooth and shining, only slightly convex, the lateral keels projecting a short way from the sides well above the middle of the body; a few segments at the anterior end of body with a small tooth at the front corner of the keels.

Head with long, deep, median furrow on the vertex on either side of which, in front, are five to ten erect setae; surface below the antennae evenly convex and scattered with many erect setae; antennae of moderate length; joint 2 slightly longer than any of the four subequal joints ensuing, first joint glabrous, those thereafter increasingly pubescent; antennae of male a little stouter than those of the female.

First segment semi-circular with the back margin slightly emarginate at middle.

Segments 2, 3, and 4 shorter than those that follow; from segment 2 to the middle of the body the posterior corner of the keels is nearly a right angle but thereafter it is slightly produced, becoming strongly so on segments 17 and 18, particularly the latter, where each corner is broadly triangularly produced; segment 19 with the posterior corners greatly reduced in size; segments 16 to 18 wider than any others and with the dorsum flatter; pores small and opening almost straight upward from a definite depression in the expanded raised rim of segments 5 and 7 to 19 inclusive.

Last segment with a dorsal row of four setae across the middle and two other setae near the apex which is produced backward but not deflexed.

Anal valves with rather thin raised margins; preanal scale subtriangular, its posterior margin suddenly thickened.

Legs with the third joint definitely longer than any other.

Gonopods as shown in figure 24.

Type. *S. platyurus* spec. nov.

Synecheporus platyurus spec. nov.

Six males (one the type) and four females from Pico del Yaque, Loma Rucilla, between 8,000 and 10,000 feet elevation, Dominican Republic, June 1938; other males and females from Loma Rucilla and mountains north, 5,000 to 8,000 feet elevation, the same month.

Characters not given in the generic description are as follows: Body from 21 to 25 mm long and up to 3.5 mm wide. Color probably white in life, rather light brown in alcohol, apparently stained.

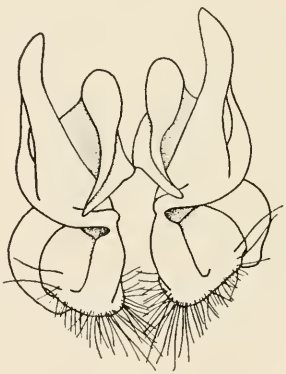

Fig. 24. *Synecheporus platyurus.* Gonopods.

Beginning at segment 2 and extending to segment 5, 6, 7, or even to segment 8, a small tooth is found on the rounded anterior corner of each keel; from segment 5 to 19 inclusive only segment 6 is without pores; preanal scale subtriangular with the apex produced slightly as that in *Achromoporus* Loomis; the entire back margin suddenly thickened, lowest and narrowest at the sides, highest and broadest at the apex, near each side of which an erect seta projects from the thickened margin.

Male legs 3 to 7 with the second joint swollen next to the body, the other joints also a little stouter than on ensuing legs; sterna and ventral surfaces of the legs in front of the gonopods beset with long hairs; all sterna and legs of the females and those of the male, following the gonopods, with a few scattered hairs.

POLYDESMIDAE

Cryptogonodesmus Silvestri

Cryptogonodesmus Silvestri, Anal. Mus. Nac. Buenos Aires, Vol. 6, pp. 59–60, 1898.

Chilaphrodesmus Loomis, Smith, Misc. Coll., Vol. 89, No. 14, pp. 42–43, 1934.

There appears to be no doubt as to the correctness of the above synonymy.

Cryptogonodesmus rubellus (Loomis)

Chilaphrodesmus rubellus Loomis, Smiths. Misc. Coll., Vol. 89, No. 14, pp. 42–44, 1934.

A female from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

Cryptogonodesmus darlingtoni spec. nov.

One male (type) and three females from Loma Vieja, south of Constanza, elevation about 6,000 feet, Cordillera Central, Dominican Republic, August 1938.

Diagnosis. A larger species than *C. rubellus* and with the outer margin of the keels smoother, their posterior corners less acutely produced. The gonopods further distinguish it from *rubellus* as well as from the South American species.

Description. Length 7.5 mm; color in alcohol light brown; with sufficient magnification the entire dorsal surface of the metazonites and the exposed portion of the prozonites is seen to be densely covered with fine smooth granules of uniform size; dorsum of the segments with the quadrate areas separately elevated and easily distinguishable; dorsal setae of segments 2 to 19 in three transverse series,

four in the front series, six in each of the following series, those of the last series projecting backward from the straight and smooth posterior margin; outer margin of the lateral keels not dentate or serrate as in the other species, smooth or at most slightly undulate at the marginal setae of which there are three on the nonporiferous segments and four on those with pores.

Antennae much like those of *C. rubellus* but possibly a little more slender.

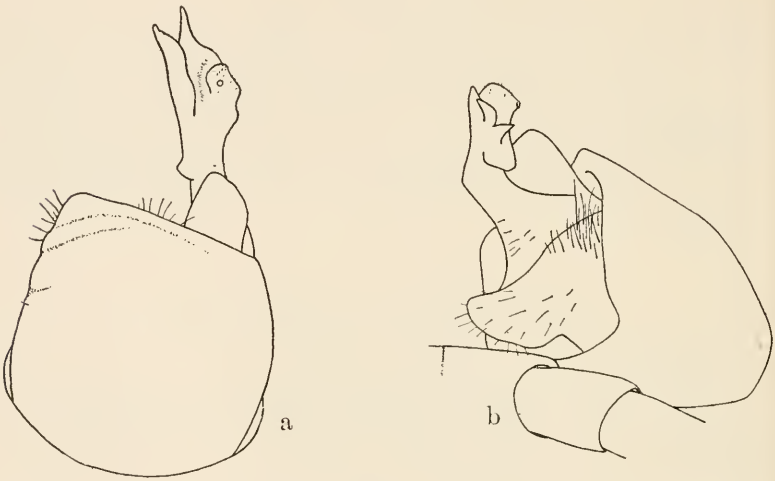

Fig. 25. *Cryptogonodesmus darlingtoni. a,* Gonopod, oblique lateral view; *b,* Gonopod, posterior view.

First segment nearly semi-circular in outline, the front margin broadly rounded, the back margin almost straight, faintly bisinuate; surface with setae as in *C. rubellus,* an anterior row of ten, a median row of four, and a posterior row of six setae.

Second segment with lateral keels directed farther forward than in the other species, the outer margin rounded and without definite anterior or posterior corners; keels of segments 3 and 4 also somewhat carried forward, rounded at the anterior corner but with the posterior corner marked by the small tooth bearing the last of the three marginal setae; the other nonporiferous segments have similar posterior corners on the keels which are much less conspicuous than those of *C. rubellus,* and there is only a tiny sinus or emargination at the base of each keel

behind; poriferous segments with the posterior corners blunter than those of *C. rubellus* and with the pores opening obliquely backward from between the last two marginal setae much as in *C. brevicornis* Carl, the pores scarcely dorsal.

Segments 18 and 19 with the poriferous corners much more slender and acute than those of preceding segments, moderately produced beyond the straight posterior margin.

Gonopods as shown in figure 25, *a* and *b*.

Legs and sterna on both sides of the gonopods without special modifications.

CHYTODESMIDAE

Key to the West Indian Genera of Chytodesmidae

Pore formula irregular, the pores present on segments 5, 10, 13, 16, 17, 18, and 19 ..... *Henicomus* gen. nov.

Pore formula normal, the pores present on segments 5, 7, 9, 10, 12, 13, 15, 16, 17, 18, and 19 .....

First segment with the posterior margin coarsely scalloped ..... *Lobodesmus* Loomis

First segment with the posterior margin simple or very indistinctly scalloped ..

Segments with slender tubercles bent toward rear ..... *Cyphotylus* Loomis

Tubercles usually low, often indistinct, never raised and bent backward .....

First segment elliptical or oval in outline ..... *Coccoelasma* Loomis

First segment with front margin rounded but hind margin definitely angled ...

Body very strongly arched, the lateral keels sharply descending ..... *Iomoides* Loomis

Body slightly arched at most, lateral keels nearly horizontal .....

All margins of the lateral keels with conspicuous lobes between deep incisions ..... *Iomus* Cook

Keels with not more than one margin having strong lobes separated by deep incisions .....

Posterior margin of lateral keels with one or two large lobes bounded by deep incisions ..... *Melanodesmus* gen. nov.

Outer and usually the posterior margin of the keels with small scallop-like lobes none of which are separated by deep incisions .....

Poriferous keels of segments 7, 9, 10, 12 and 13, with three scallop-like lobes on the outer margin ..... *Tridesmus* Cook

Poriferous keels of above segments with four lobes instead of three on the outer margin of each segment ..... *Docodesmus* Cook

Docodesmus alifer spec. nov.

Female type and another female from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Dominican Republic, June 1938.

Diagnosis. This is a most unusual species in that the lateral keels, instead of descending or being held horizontally, are strikingly elevated, with their outer margins as high or higher than the middle of the dorsum. Also the dorsum is less sculptured than in any other known species.

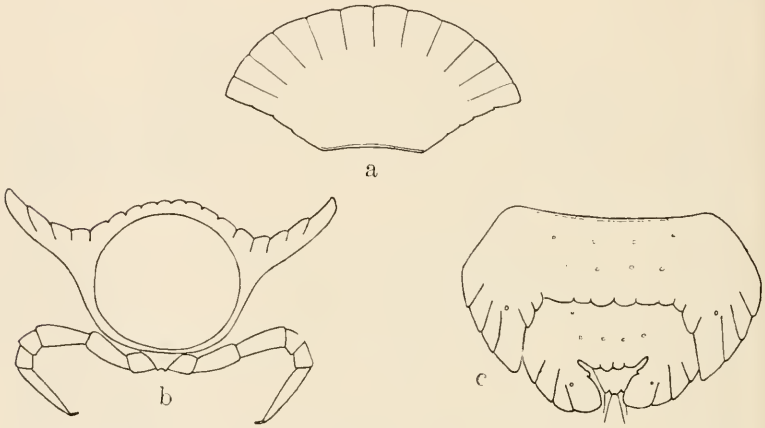

Fig. 26. *Docodesmus alifer. a,* Segment 1, dorsal view; *b,* Segment 4, posterior view; *c,* Segments 18 to 20, dorsal view.

Description. Length 16 to 17 mm, width 3 mm. Both specimens light brown, probably white in life from which it may be inferred that maturity had just been reached before capture, as brown to almost black is the usual color of old specimens in the genus.

Head with the antennae slightly longer and more slender than in other large species, joint 5 considerably the longest, exceeding joints 6 and 7 together; surface in front and to the side of each antenna raised into a broad low ridge behind which the basal joints of the antenna lie when at rest.

First segment quite long as shown in figure 26 *a,* its latero-posterior margins slightly scalloped, very oblique, longer than the median portion which is almost straight and bordered by a raised rim; anterior

expanded margin raised much higher than the central region, its quadrate areas much longer than broad, especially the outer ones; central region nearly flat, almost smooth, the usual tubercles very faintly indicated by tiny low swellings.

On ensuing segments the lateral keels are thin and extend obliquely upward far from the sides of the body, the outer margins as high or even higher than the dorsum itself, as shown in figure 26 *b;* inner area of each keel depressed below its margins; non-poriferous segments and segment 5 with 3-lobed keels, the other poriferous segments with 4-lobed keels, none of the outer margins strongly scalloped as are the posterior margins of the keels and the dorsum; the sulci separating the marginal areas of the keels and dorsum well impressed, constituting the most conspicuous sculpturing of the segment, as the usual transverse areas of the dorsum are but faintly indicated, if at all, and the central tubercle of each area is almost obliterated; the entire surface dully shining and less sculptured than in any other known species; raised rim at the front of each segment low, thin and inconspicuous on the dorsum as well as on the keels.

Penultimate segment with keels slightly raised, unusually large as compared with those of other species, produced backward and sharply inward, the sinus between them wide in front but narrow between the blunt tips of the keels as shown in figure 26 *c*.

Last segment small, much exceeded by the keels of the penultimate segment; without dorsal tubercles but with two small apical lobes and another small lobe on either side.

Ventral ridge of the third segment narrow and high, rising to a median point, thus it is triangular in outline and is inclined toward the rear.

Docodesmus griseus spec. nov.

A dozen specimens, including the male type, collected at Sanchez and vicinity, Dominican Republic, July 1938.

Diagnosis. The smaller size, lack of secondary tubercles on the dorsum, the greater accentuation of the primary ones, and the more acute keels at the posterior end of the body distinguish this species from *D. haitiensis* Chamberlin. The males have the keels of segments 2, 3, and 4 distinctly lifted above the horizontal and the coxae of the fourth legs have hispid swellings not found in other species.

Description. Body up to 14 mm. long and 3 mm broad; color nearly white to light grayish brown in alcohol.

Head with antennae white, quite long and slender, joint 5 longest and broadest; surface above the antennae finely granular, median channel faint; surface between and below the antennae smooth, shining, and finely hispid, the clypeal region only slightly inflated but laterad of each antenna a broadly swollen ridge is present.

In general the shape of the body and of the individual segments, their position and sculpturing resemble *D. haitiensis* but the following differences are noted. In the males the keels of segments 2, 3, and 4

Fig. 27. *Docodesmus griseus.* Right hand gonopods with sternum and coxal joints of ensuing legs.

are obliquely raised a little above the horizontal; the posterior segments of both sexes have the keels produced farther backward and more acute; quadrate areas of the dorsum with the central tubercle larger, no additional smaller tubercles present; raised ridge across the front of each metazonite as high or higher than in *D. haitiensis* and more irregular at apex.

Anal valves notably flattened, especially near the scale, the margins lower and broader than usual; surface, and that of the scale, smooth and shining.

Gonopods as shown in figure 27.

Males with each coxal joint of the fourth legs bearing a broad, low swelling covered with fine erect setae.

Females with the ventral crest of the third segment higher than in most other species, thin, rising gradually from each side to the broadly rounded median portion; surface behind the crest low and nearly flat.

Docodesmus haitiensis Chamberlin

Docodesmus haitiensis Chamberlin, Bull. Mus. Comp. Zool., Vol. 62, No. 5, p. 216, 1918.

Two males and two females from Mt. Diego de Ocampo, Northern Range, elevation 3,000 to 4,000 feet, Dominican Republic, July 1938.

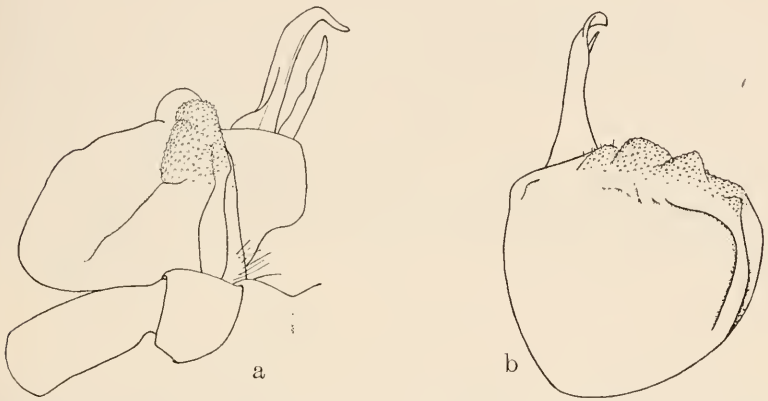

Fig. 28. *Docodesmus haitiensis*. *a*, Left hand gonopods, posterior view; *b*, Gonopod, lateral view.

While these specimens differ very slightly from typical *haitiensis* the differences appear too insignificant to justify recognition as even a variety.

A drawing of the gonopods of this species from a specimen collected at Trouin, Haiti, is shown in figure 28.

Docodesmus angustus spec. nov.

Four males, one the type, and eight females from Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Dominican Republic, August 1938; one male from rain forest near Valle Nuevo at about 6,000 feet elevation, August 1938; several males and females from Loma Vieja, south of Constanza at about 6,000 feet elevation August 1938; a male and female from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, June 1938.

Diagnosis. The wide second segment, gradually attenuated pos-

terior end of body, and conspicuous lobes on outer margins of keels, are noteworthy characters supplementing those shown by the gonopods.

Description. Body quite slender for its size, the largest female being 18 mm long and 3.5 mm wide, the largest male 15 mm long and 2.7 mm wide; sides of body parallel from segment 2 to near the posterior end of body which narrows more gradually than in other known species; color in alcohol rather dark brown with the lateral keels a little lighter.

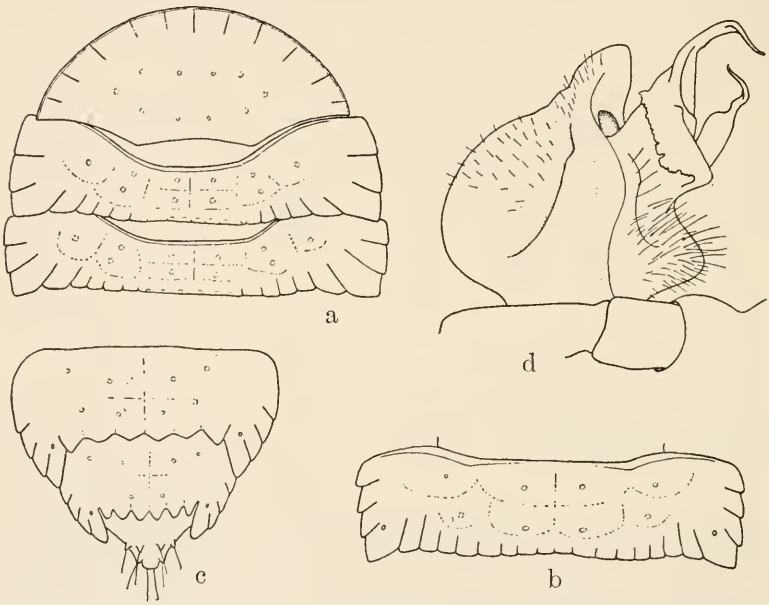

Fig. 29. *Docodesmus angustus*. *a*, Segments 1 to 3, dorsal view; *b*, Segment 10, dorsal view; *c*, Segments 18 to 20, dorsal view; *d*, Left hand gonopods, posterior view.

Head with antennae short and stout as in most species, the outer sides of the head in front of them swollen; vertex minutely granulose, the median furrow fine and short, stopping considerably above the antennae between and below which the surface is finely hispid.

First segment short and conspicuously narrower than segment 2 as shown in figure 29 *a*, the front margin evenly rounded without indication of scallops, but with a fine raised rim; dorsal sculpture of this and succeeding segments quite similar to, but not as strong as, that of the

much smaller *D. parvior,* shown in Bul. Mus. Comp. Zool., Vol. 80, No. 1, pl. 3, 1936.

All segments, except three or four at each end of body, have the outer margin of the lateral keels more definitely lobed than in other species as shown in figure 29 *b.*, the raised rim across the anterior border of each segment is fairly well developed on anterior segments but thereafter gradually diminishes and on the posterior segments is limited to the lateral keels or is lacking; posterior segments narrowing gradually as shown in figure 29 *c*, in which the difference in size of the produced keels of segments 18 and 19 may be observed and also the considerable exposure of the last segment which projects far behind the keels of the penultimate segment.

Gonopods as shown in figure 29, *d.*

In the female the anterior ventral crest of segment 3 is raised as in other species but the entire surface behind it is raised into a thickened ridge almost as high as the anterior crest, a condition observed in no other species of this genus.

Melanodesmus genus nov.

Diagnosis. Apparently most closely related to *Docodesmus* but differing in having the entire dorsum, including the tubercles, evenly finely granulose; and the posterior margin of each segment has two deep incisions at the base of the lateral keel, the intermediate margin a conspicuous lobe.

Description. Body of the shape and proportions of *Docodesmus;* black; the entire dorsum, including the large tubercles, finely and evenly granulose.

Head with the vertex finely granular, without a definite median furrow; surface between the antennae hispid, the clypeal region smooth and shining and somewhat inflated; antennae quite short and stout, quite densely pubescent.

First segment noticeably narrower than those that follow; shaped as in *Docodesmus* but the marginal areas less distinct and the margin more continuous; posterior margin with a small incision at the base of the expanded margin; central area with ten tubercles.

Ensuing segments with keels projecting outward almost horizontally from well above the middle of the body, the outer lobation of the keels as in *Docodesmus* but the front margin thicker; the posterior margin thin and with two wide and deep incisions having a prominent lobe between them at the base of the keel; dorsum with quadrangular

areas faintly perceptible or not at all; four longitudinal rows of large granule-bedecked tubercles present, three tubercles in each row except on the anterior segments, the third tubercle in each row broader and less distinct than the others and occupying a small lobe of the posterior margin; front margin of each metazonite with an irregularly raised rim extending across the dorsum and half way or more across each keel; posterior end of body narrowing suddenly and with the large tubercles decreasing in size; keels of segment 19 considerably smaller than those of segment 18, with the last segment exposed in the sinus between them.

Anal valves moderately inflated, shining, almost smooth; raised margins thin.

Preanal scale triangular, with a setose conic tubercle rising from the surface on either side near the apex.

Third segment of the female with a high thin crest along the anterior margin behind the second legs.

Type. *M. granulosus* spec. nov.

Melanodesmus granulosus spec. nov.

A single female collected between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

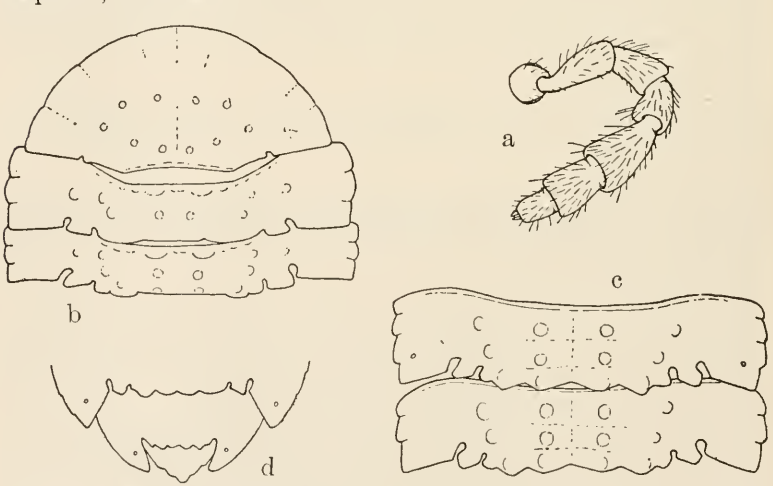

Fig. 30. *Melanodesmus granulosus*. *a*, Antenna; *b*, Segments 1 to 3, dorsal view; *c*, Segments 10 and 11, dorsal view; *d*, Segments 18 to 20 in outline, dorsal view.

Length 8.3 mm, width 2 mm; dorsum entirely dull black, the front of head, antennae, legs, sterna, hispid apex of last segment, anal valves and preanal scale white or colorless, remaining ventral surfaces black.

Head with hispid antennae as shown in figure 30, *a*, joints 6 and 7 together longer than either joint 2 or 5 which are subequal in length with the latter exceeding any of the other joints in width.

First segment distinctly narrower than segment 2 as seen in figure 30, *b*, almost semi-circular with the expanded front margin not appreciably scalloped, a few short indistinct lines giving faint indication of the usual quadrate areas; posterior margin with a small incision near the middle of each oblique section.

Segments 2 and 3 with dorsal tubercles as shown in figure 30, *b*, but on ensuing segments they are as shown in figure 30, *c*, except that on the caudal segments the tubercles decrease in size; the segments at the posterior end of the body shown in outline in figure 30, *d*.

Third segment of the female with the very thin ventral crest slightly higher at each side than at the middle.

Iomoides parallela spec. nov.

Male type and two females from Sanchez and vicinity, Dominican Republic, July 1938.

Diagnosis. Similar to *I. glabra* Loomis in the hairless dorsum but differing in the larger size; greater development of the dorsal sculpture, with the four rows of tubercles parallel to each other; and in the form of the gonopods.

Description. Body longer and relatively broader than *I. glabra*, from 8.5 to 9 mm long and 2 to 2.2 mm wide, the dorsum without setae; all the tubercles larger and more prominent than in that species; color in alcohol black.

First segment with the anterior margin a little more rounded and scalloped than in the other species; disk with an anterior row of six tubercles, the outer one on each side very small, the next double its size and the inner one double the size of the second and much higher; in the posterior row of four tubercles the outer one is slightly smaller than the second tubercle of the first row, and the inner tubercle is as small or even smaller than the outer one of that row.

On ensuing segments the four rows of tubercles are strongly elevated, especially the two inner rows; all rows parallel instead of extending obliquely mesad from front to back; on segments 16 to 18, quite in contrast to the condition in *I. glabra*, the posterior tubercle

most developed and projecting caudad especially on segment 18; on segment 19 the anterior tubercle of each inner row is very small and hidden beneath the projecting tubercle of the preceding segment, second tubercle slightly larger, the last tubercle almost as large as that of the foregoing segment and projecting straight back contiguous to the last tubercle of the opposite row; segment 19 broader than in *I.*

Fig. 31. *Iomoides parallela.* Left hand gonopod, mesoposterior view.

glabra, the posterior corner of the keels only slightly exceeded by the tips of the median tubercles; lateral keels of all segments definitely thicker than in *I. glabra*, the sinuses between the lobes of the anterior and posterior margins more open.

Gonopods as shown in figure 31.

Females with the ventral crest of segment 3 broader and lower than in *I. glabra.*

Iomoides conjuncta spec. nov.

A single male collected at Villa Altagracia, Dominican Republic, July 1938.

Diagnosis. Intermediate between *I. hispida* Loomis and *I. parallela,* but lacking the long seta on each dorsal tubercle as in the former species and with much coarser dorsal sculpture; from *I. parallela* it differs in the hispidulous dorsum and the oblique rows of tubercles; the coalescence of the three tubercles in each inner row, forming simple crests on segments 2 to 5, does not occur in the other three species.

Description. Color black as in the other species; the body somewhat broader, being 8 mm long and 2.4 mm wide; the dorsal surface densely hispidulous but lacking the long seta on each tubercle as found in *I. hispida.*

First segment with the ten rectangular areas of the front margin long, especially the outer three on each side which are over twice as long as wide; inner surface strongly convex with an anterior row of six tubercles and a posterior row of four tubercles, the tubercle at each end of the front row and the inner pair of the back row are very minute; the second tubercle in the front row and the outer one in the back row are somewhat larger but less than half as large or as high as the inner pair of sharply conical tubercles of the front row.

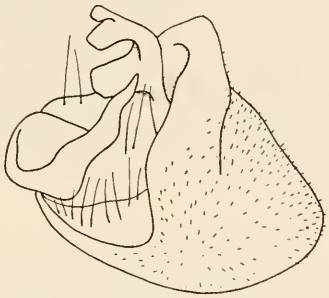

Fig. 32. *Iomoides conjuncta*. Right hand gonopod, mesoposterior view.

On segments 2 to 5 the tubercles of each inner row are coalesced and elevated into a simple ridge definitely higher than the corresponding rows of tubercles on mid-body segments, the two ridges on segment 2 are short but increase in length on succeeding segments; on segment 5 the individual tubercles composing each ridge are faintly evident and on segments 6 and 7 become more separated and thereafter are completely separated and lower; on segment 17 the last tubercle of each inner row is suddenly enlarged and produced backward far beyond the posterior margin; segment 18 with these tubercles almost as large and greatly produced but the two foregoing tubercles in each row are reduced to insignificance; from segment 2 to segment 18 the outer and inner rows of tubercles are oblique and converge caudally toward the median line, except those rows on the anterior segments which are developed into parallel crests; the tubercles of each outer row are of uniform size throughout the body, arranged in a curved oblique line, the middle tubercle farthest laterad, followed by the anterior one, with the posterior tubercle nearest the dorsum; segment 19 without dorsal tubercles except the posterior one of each median row, the two tubercles strongly projecting backward, touching along the inner side and to-

gether filling the sinus between the lateral keels, which they slightly exceed; on segments 2 to 19 each outer lobe of the lateral keels has a single seta in the margin slightly larger than those of the dorsal surface but smaller than the corresponding setae in *I. hispida.*

Gonopods as shown in figure 32.

Male with the second joint of legs 3 and 4 thicker than on the adjacent legs.

Iomoides sp.

A 19-segmented male from the rain forest near Valle Nuevo, Cordillera Central, elevation about 6,000 feet, Dominican Republic, August 1938.

The dorsal vestiture is like that of *I. conjuncta* although the sculpture, which resembles that of *I. hispida,* precludes its inclusion in the former species, but because of the immaturity of the specimen, a new name is not considered justified.

Henicomus genus nov.

Diagnosis. Outstanding feature of this genus is the pore formula which not only is unique in the family, where a normal formula is the rule, but it is not known to be duplicated elsewhere in the order Merocheta. The sequence of three-and four-lobed lateral keels is another curious and unique character. General form and sculpture suggest closest relationship with *Docodesmus* but the dorsum is more convex, with strongly descending lateral keels, and the anterior and posterior sterna of each segment are separately elevated.

Description. Body small, about six times as long as broad; dorsum strongly convex with lateral keels sharply descending to opposite the middle of the body or lower; sculpture resembling the type common in *Docodesmus* but not as distinct.

Head and antennae much as in *Docodesmus.*

First segment with the expanded front margin divided into 12 quadrate areas of which the outermost on each side is much narrower than any of the others; median area strongly convex, not divided into geometric areas but with ten tiny tubercles arranged as in *Docodesmus.*

Ensuing segments with faintly set-off quadrate areas each usually containing an indistinct tubercle; dorsum of these segments high and strongly convex, the lateral keels not projecting as far from the sides of the body as in *Docodesmus* and much more deflexed, the outer margin reaching opposite the middle of the body or below it; the outer

margin of segments 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, and 16, three-lobed; the margin of segments 7, 9, 12 and 15 distinctly four-lobed; the margin of segments 17, 18 and 19 indistinctly and apparently indiscriminately three- or four-lobed; pores opening from the dorsal surface of the posterior lobe of the keels on segments 5, 10, 13, 16, 17, 18 and 19.

Last segment with two dorsal sub-median tubercles and a smaller one further forward near each side; apex slightly deflexed.

Anal valves but little convex, the thin margins only slightly raised; preanal scale rounded-triangular behind, with a large conic setiferous tubercle on either side surpassing the posterior margin.

Sterna definitely elevated, narrow, more so than in *Docodesmus*, and with a longitudinal median furrow; on segments having two pairs of legs the sterna are separated by a deep transverse channel.

Second legs of female followed by a raised transverse ridge.

Type. *H. septiporus* spec. nov.

Henicomus septiporus spec. nov.

A single female collected at about 6,000 feet elevation, Loma Vieja, Cordillera Central, south of Constanza, Dominican Republic, August 1938.

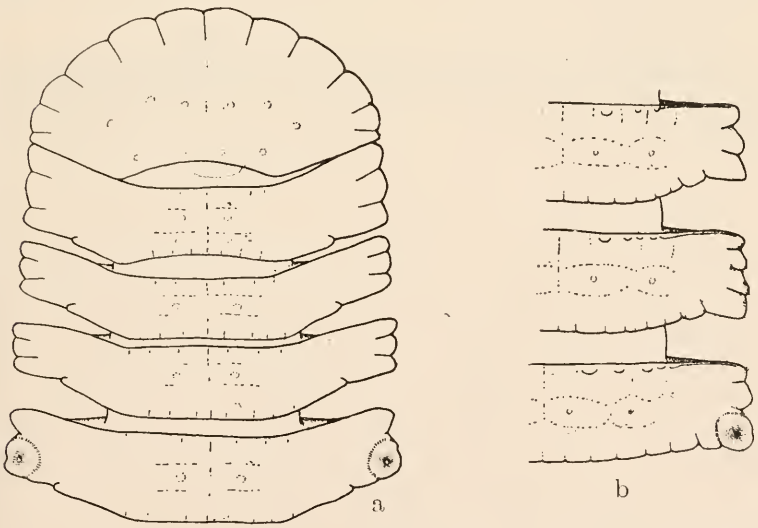

Fig. 33. *Henicomus septiporus*. *a*, Segments 1 to 5, dorsal view; *b*, Right hand half of segments 11 to 13, dorsal view.

Length 9 mm, width 1.5 mm; color in alcohol cinnamon brown. Segments 1 to 5 shown in figure 33, *a*, lateral carinae not projecting far enough to hide the distal half of the last joint of the legs; pores opening from the center of a broad, shallow, crater-like depression in a special swollen area which occupies the whole of the last lobe of the keel; on segments 5, 10, and 13 the lobe is rounded behind as shown in figure 33, *b*, but on segments 16 to 19 the lobes are produced backward into sharp angles, those of segment 19 not as long as on segment 18, widely separated, the last segment visible between them and extending a considerable distance beyond; segment 19 with six prominent scallops occupying the posterior margin between the poriferous keels; similar scallops, decreasing in size, are present on segments 18 and 17; figure 33, *b*, also shows nonporiferous three- and four-lobed keels.

Crest following the second legs of the female high, thin, and extending opposite the middle of the second joint of the leg on either side.

COMODESMIDAE

Inodesmus caraibicus (Silvestri)

Lasiodesmus caraibicus Silvestri, Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 575–576, 1908.

A female from El Yunque, Puerto Rico, May 1938.

The length, not given by Silvestri, is 7 mm, the width about 0.75 mm. In other particulars the species has been well described and illustrated.

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BIRDS OF LOWER AMAZONIA

BY LUDLOW GRISCOM
AND JAMES C. GREENWAY, JR.

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By Ludlow Griscom and James C. Greenway, Jr.

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INTRODUCTION

For several years prior to 1932, A.M. Olalla and various assistants sent enormous collections of birds from the Amazon River Valley to the American Museum of Natural History in New York. The area covered included every important tributary river except the Purus. With headquarters at Obidos, A. M. Olalla continued collecting in 1932 and 1933, and this collection, totalling 4023 skins, was purchased by the Museum of Comparative Zoölogy. The inception of this paper was the identification of this collection, which proved to contain a few novelties, many rarities, and numerous range extensions.

As Snethlage's Aves Amazonicas was hopelessly out of date, and the American Museum had no plans for working up and reporting on their Amazonian collections except in connection with other projects, it seemed possibly more useful to try and present a complete and up-to-date list, with such systematic notes as the material at our disposal made possible. In this connection the great Klages Collection at the Carnegie Museum at Pittsburgh was a possible mine of interesting information. We learned that our good friend, Mr. W. E. Clyde Todd, had no immediate plans for preparing a report on this collection, in the press of various other projects approaching completion.

We accordingly sought and obtained permission to study this great collection and to include in this report the specimens in the Carnegie Museum and all information in any way supplementary to that already available. Such generosity and cooperation is most unusual, and we here gladly express our sense of deep obligation and appreciation to the Director of the Carnegie Museum, Dr. Avinoff, and our colleague Mr. Todd, who did everything possible to assist us while at Pittsburgh. By agreement with these two gentlemen we described such new forms as were represented by specimens in both institutions, and Mr. Todd published a series of papers on the novelties in the Carnegie Museum alone.

PRINCIPAL COLLECTIONS

Hellmayer's classic paper on the birds of Pará (Abh. Konigl. Bayer. Akad. Wiss., Math. Phys. Klasse, **26**, 1912) gives a summary of various small collections in Europe from the vicinity of Pará and Marajó Island. These include such historic collections as Natterer's at Cajutuba in 1835, and Wallace's birds from the Rio Capim in the British Museum. Early American collections were those of Prof. Steere on

Caviana and Marajó Islands in 1871 and 1879 (reported on by Brodkorb in 1937) and two made at Santarem, reported on by Ridgway, Chapman and Riker.

The Goeldi Museum at Pará was founded in 1891 by Dr. Goeldi, who secured some material from Lower Amazonia, but Dr. Emilia Snethlage for years explored up and down the Amazon River with indefatigable energy and enthusiasm, and her important collections culminated in her great work, Aves Amazonicas (1914).

Various other Brazilian ornithologists have contributed to our knowledge of the birds of the Lower Amazon, among them C. O. da Cunha Vieira, Dr. Miranda-Ribeiro and Pedro Pinto-Peixoto, all reporting on small collections in Rio de Janeiro or Saõ Paulo. Today the leading ornithologist of Brazil is Dr. O. M. de Oliveira Pinto, whose monumental catalogue of the birds of Brazil, Part I, lists the specimens of a final collection made by A. M. Olalla in 1934, acquired by the Museu Paulista. We are much indebted to him for complimentary copies of his invaluable papers.

As already stated the Olalla collection purchased by the M.C.Z. totals 4023 specimens. Fortunately, Mr. Zimmer of the American Museum, in connection with his studies of Peruvian birds, has studied and listed the material in New York of the difficult passerine families in the superfamily Furnariides. The balance of the Olalla collections in New York are not reported on.

The Klages Collection in Pittsburgh contains 7379 specimens from our area in lower Amazonia; about nine thousand specimens from upper Amazonia and seven thousand from French Guiana and adjacent Brazil afforded magnificent comparative material.

GEOGRAPHICAL NOTES

Area Included

As is almost invariably the case, it is quite impossible to select as a unit an area in which political, geographical and faunal boundaries coincide. Our principal object has been to compile a list of the rich bird-life known to date from the Lower Amazon. The western limits of the area are the western boundaries of the State of Pará, which on the south side of the Amazon, runs between the Rio Tapajoz and Rio Madeira. On the main river, just a few miles west of this boundary line, is the city of Villa Bella Imperatriz or Parintins, and the few birds recorded from here are included. On the north bank, the town of

Faro on the Rio Jamundá is about on the State boundary line. Faunally there is here no embarrassment or difficulty, as new genera and species of birds are encountered the moment we proceed still further west to the Rio Madeira and Rio Negro.

The eastern limits of our area must be selected on a more arbitrary basis, as the coast of Brazil happens to run eastward from the mouth of the Amazon. In this region lies the boundary between the States of Pará and Maranhão, and somewhere in here there is also an important faunal boundary, as we pass from the great river forests of the Amazon to the campos of Maranhão. Little or no exact detail is on record.

Theoretically, our northern and southern boundaries should include the whole drainage system of the Amazon. Actually, this would include a gigantic area, stretching from the Brazilian Guianas to the tableland of northern Matto Grosso, one of the greatest unexplored areas of wilderness in the world, with scarcely a bird skin on record. On the north bank of the Amazon, the rivers are relatively small, and no collecting has been done more than a few miles north of the main river. On the south bank, however, the great rivers Tapajoz, Xingú, and Tocantins rise far south of the boundaries of the State of Pará, but we are here concerned only with the relatively few miles along which ornithological collections have been made. Even the uppermost points reached by Madame Snethlage in her traverse from the Xingú to the Tapajoz are little more than half way to the Pará-Matto Grosso boundary.

As thus outlined, the area included in this report is the lowest quarter of the main Amazon, and its tributary rivers to the degree to which they have been ascended by ornithological collectors. It is consequently a mere fraction of area in terms of square miles of the State of Pará, and a still smaller fraction of the drainage system of the main Amazon.

COLLECTING LOCALITIES

In Lower Amazonia the rivers are the main highways of travel, and the only means of access to most of the interior. Practically all towns, villages and hamlets are on some well known river or one of its tributaries. Thus, if you are at Pará and wish to go to Santa Helena, you must go up the Amazon to the mouth of the Rio Tapajoz, up the Tapajoz to the mouth of the Rio Jamauchim, and up the Jamauchim until you reach this particular hamlet. In much of Lower Amazonia, an overland or "cross-country" trip between two rivers has never

been done, or at least would require a well equipped and competently led expedition in the dry season. The rivers are consequently used almost entirely in orienting place names. First of all, you are on the north or south side of the main Amazon; secondly, you are located on the west or east bank of some tributary, or your locality is defined in terms of the mouth of the nearest well known river. Thus, Arumanduba is on the north bank of the Amazon, between the Rio Parú and the Rio Jary.

It is important for readers to remember that the Brazilians frequently use the terms right and left for river banks, in which case the river is always thought of as being descended. This is quite simple in the case of a river like the Tapajoz, flowing from south to north, where the east bank is automatically the right bank, but this situation is reversed in those rivers flowing into the Amazon from the north, and one sometimes has to stop and think before realizing that the right bank of the main Amazon is the south bank.

In this connection Brazilian Portuguese has adopted certain Indian words into the language which frequently occur in place names. *Igarapé* means stream, creek, or bayou; *cachoeira* means a rapid; *assú* means big. Such local place names have often in the past been selected as ornithological collecting localities, with exceedingly poor judgment. Fortunately, we know approximately where Igarapé-assú is. It is nothing in the world but a large creek, an affluent of the Rio Acará, above the town of Acará. Two or three seasons of particularly heavy freshets and floods might completely eliminate some *igarapé*.

Any atlas map of Brazil shows all the principal rivers and towns mentioned in this report. Minor place names can readily be found by consulting the map at the end of Snethlage's Aves Amazonicas. Details of place names on the Rio Tapajoz can be found on the map in Snethlage's article in Bol. Mus. Goeldi, **7**, 1910. For the convenience of the reader, the principal localities are roughly placed in the schematic arrangement adopted below. We proceed from west to east.

I. North bank of main Amazon
   Rio Jamundá—Faro (Snethlage and A.M.N.H.)
   Obidos, a large city and port, with numerous minor collecting stations near by. The Carnegie Museum has a large collection from some islands in the Amazon near Obidos. (Numerous collectors)
   Rio Maecuru—Cachoeira Muira and Igarapé de Paituna (Snethlage)

Monte Alegre and Ereré (chiefly Snethlage)
Rio Parú (no collections)
Arumanduba (Snethlage)
Rio Jary—So. Antonio de Cachoeira (Snethlage)
Macapá (Snethlage)
Amapá (Snethlage)

II. South bank of main Amazon
Villa Bella Imperatriz or Parintins (A.M.N.H.)
Lago Grande (M.C.Z.)
Rio Tapajoz (all collectors)
a. left bank—Villa Braga, Itaituba, Pinhel, Boim
b. right bank—Apaçy, Miriituba, Aveiros, Caxiricatuba, Tauary, Pinhy
c. Above or upstream from these localities the Rio Jamauchim comes in from the southeast.
Santarem, a small city and port (all collectors)
Cussary, about half way to the
Rio Xingú- Victoria, Boa Vista. Just upstream from these towns, the Rio Iriri debouches from the southwest, and still further inland the Rio Curuá comes in from the southwest (Snethlage and A.M.N.H.)
Rio Tocantins (Snethlage and A.M.N.H.)
a. left bank—Arumatheua, Alcobaça, Cametá
b. right bank—Baiaõ, Porto do Moz
Rio Mojú
Rio Acará-Acará, Igarapé-assú
Rio Capim, which flows into the
Rio Guamá—Ourem
Pará, the capital city, also known as Belem, has numerous suburbs, among them Providencia, Ananindeua and Val-de-Caes.
Railroad from Pará to Bragança on the Atlantic.
Well known stations are Benevides, Peixe-boi, and Quatipuru. St. Antonio do Prata is a small town south of Peixe-boi.

III. Mouth of the Amazon
Innumerable islands, of which the very large one is Marajó. Two small outside islands are Cavianna and Mexiana.

An excellent gazetteer of localities worked by older collectors can be found in Hellmayr's classic paper in Abh. Königl. Bayer. Akad. Wiss., Math. Phys. Klasse, **26**, 1912, pp. 84–85. Of these the only important

one, not on Snethlage's map, is Natterer's famous station Cajútuba, a beach on the sea-coast northwest of Cintra. Here Natterer collected 105 years ago various wading and sea birds, never since reported from the region.

Some readers may like to get some idea of the geography of Lower Amazonia. In addition to the standard books of travel on the Amazon River, the following articles are recommended:

1. Snethlage, Bol. Mus. Goeldi, **6**, 1910, pp. 226–235, deals with the savannahs on the upper Tocantins.

2. Snethlage, *ibid.*, **7**, 1910, pp. 49–92, map and 15 plates, deals with her famous trip up the Rio Xingú and her traverse across country to the Rio Jamauchim.

3. Ducke, *ibid.*, pp. 100–197, and 12 plates, while primarily botanical, gives an excellent idea of the types of country around Faro and Obidos.

4. Müller, Abh. Königl. Bayer. Akad. Wiss., Math. Phys. Klasse, **26**, 1912, pp. 1–80, describes the savannahs of Marajó Island and the country near the capital city of Pará.

Collecting Localities of A. M. Olalla

Rio Tapajoz: Santarem

A locality situated at the junction of the Amazon with the river of this name. A small city, with considerable commerce, and a port that can accommodate any of the local ships. The built-up part is surrounded by savannahs for a distance of about two kilometers, beyond which the dense vegetation, high and savage, begins. The land is relatively level as far as the Hacienda of Piquiatuba, where a slope begins and ends with the plateaus of the farms of San José. The climate is healthy, without plagues of mosquitos. Birds abundant, but mammals rare.

Rio Tapajoz: Caxiricatuba

A locality situated on the eastern shores of the Rio Tapajoz about 21 miles from Santarem; the place is inhabited by two native families. The terrain is varied, including Igapò on the shore of the river, and there is dry land with virgin forest in the center. Birds and mammals relatively common.

Rio Tapajoz: Tauary

Near Caxiricatuba, about 24 miles from Santarem, and is also on the east side of the river. The *igarapé* is navigable for small craft in the winter (wet season); some natives live there. The terrain and flora

are similar to those of Caxiricatuba. Birds and mammals abundant. An *igarapé*, with a fairly long course from its source to its junction with the Tapajoz.

Rio Tapajoz: Patauá

The central locality situated about 4 miles to the east of Tauary. Region uninhabited; virgin forest; terrain varied and dry. Birds and mammals abundant.

Rio Tapajoz: Pinhy or Piny

About two miles from Tauary, upstream and on the same bank of the Rio Tapajoz. A small *igarapé*, navigable at the height of the wet season, and inhabited by a few "caboclos." The terrain and flora show the same characteristics as those of Tauary. Birds and mammals abundant.

Rio Tapajoz: Boim

A small town situated opposite Tauary on the west bank of the Rio Tapajoz. A port where a few small boats stop, with a little commercial activity. Climate healthy; dry land up to the bank of the river; the forest destroyed on the river bank, but intact within. Flora notable for the abundance of "Castaneros" (*Berthileta excelsa*). Birds and mammals relatively abundant.

Rio Tapajoz: Pinhel

A small town, almost abandoned, but shown on almost all maps; located about 29 miles from Santarem on the west bank of the Tapajoz. It is surrounded by relatively level land covered with dense vegetation; beaches are exposed on the river bank at all seasons. Birds and mammals rare.

Rio Amazonas: Lago Grande

An extensive region, situated on the south shore of the Amazon between the cities of Obidos and Santarem. A central region where cattle raising is the principal occupation; low and swampy land in the wet season; the flora extensively destroyed because of the great natural and artificial fields that circle the region; inhabited by quite a few people; birds very common; mammals almost never found.

Rio Amazonas: Boca do Igarapé Piaba

A locality situated at the entrance of the paraná de Obidos (going up the river) about 12 miles from the city of Obidos on the north shore of the Amazon. The terrain completely level and swampy in the wet season; the flora typical of the lowlands of the Amazon, i.e. the vegetation low and sickly, destroyed in some places where artificial fields for cattle raising have been made; birds and mammals abundant but

very few forms represented. No collections have previously been made in this locality.

Rio Amazonas: Lago Jauary: Livramento

A locality situated about 6 miles to the northeast of Boca do Igarapé Piaba. In the wet season it is a large lake called Jauary; in the dry season it is said to dry up, only a small channel navigable for canoes remaining. There exist, also, some other small lagoons of little importance. Quite a few people live in the region. The terrain and the flora are just like existing at Boca do Igarapé Piaba. In this region, also, no collections have previously been made.

Rio Amazonas: Lago Cuipeuz o Cuipeua

A locality situated between the Boca do Igarapé Piaba and Livramento to the northwest, about 8 miles away. Distribution of the land: to the north, elevated, dry, and above water at all seasons; virgin vegetation, abundance of chestnuts, inhabited only at the season of the exploitation of these nuts, i.e. March to June; to the south, east and west, both the terrain and the vegetation are exactly similar to those of other parts of this region. No collections have previously been made in this region.

Rio Amazonas: Igarapé Matta

A locality near Igarapé Piaba on an island of dry land.

Rio Tocantins: Cametá

A small city situated on the left bank of the Tocantins River; a place sufficiently well known to the scientific world, and is found on all maps. Various collections have been made there.

Brazil, Belem, Bosque

This locality includes the surroundings of the city of Belem (Pará) on the central side, where the terrain is in part high and in part subject to floods; the forest is destroyed in some places.

Brazil, Belem: Val-de-Caes

This locality is situated about a league away on the margin of the river, down stream; a place relatively thickly populated but with sufficiently wild vegetation in the places where there are no inhabitants. The central part of this locality is completely wild. In these woods the peccary, penelope and other mammals and birds, which live entirely in uninhabited woods, have been seen.

Brazil, Rio Acará: Villa Acará

A locality situated on a bank of the river of this name; the region unhealthy, the population decadent and completely out of commission

because of malaria and other diseases. The place is found on all maps. The birds killed in this locality come exclusively from the region near to the town. On this side the terrain is high, and with woods in which hunting is easy, but destroyed in places near the town, and wild in the center. The side opposite the river is impenetrable due to the many palm trees, called "moriche", in which is found *Berlepschia rikeri* (Ridgway). Some of these palms are also found in the town.

ECOLOGICAL AND DISTRIBUTIONAL NOTES

In marked contradistinction to those parts of tropical America which contain mountain systems, a gigantic area of eastern South America has a uniformly humid tropical climate. As Chapin has so clearly shown in his study of the avifauna of the Congo, ecological factors are consequently of primary importance in the distribution of birds. Quite the most important of these is the presence of natural savannahs in the sea of primeval tropical rain forest.

This subject will receive further notice, but is mentioned here first because it explains the occurrence of two distinct Faunas in Lower Amazonia. The principal one, of course, is the Guiana-Amazonian Fauna to which the very great majority of the birds belong. A totally different one is encountered the moment we reach the higher "campos" of central Brazil or the more arid coast of Ceará and Maranhao. Birds characteristic of this fauna occur on the great savannahs of Marajó and other islands at the mouth of the Amazon, on certain savannahs on the upper reaches of the Rio Tocantins, and a very few have been collected on the north bank of the Amazon at Monte Alegre, where the savannahs deserve much more careful exploration. (A very few are reported locally elsewhere.) A list of these birds is given below; all are common and widely distributed in central and southern Brazil.

Crypturellus obsoletus griseiventris
" undulatus adspersus
Rhynchotus rufescens catingae
Polyborus plancus brasiliensis
Uropelia campestris
Guira guira
Polytmus guainumbi thaumantias
Trogon v. variegatus
Nystalus maculatus
Colaptes campestris chrysosternus
Chrysoptilus melanochloros mariae
Leuconerpes candidus
Lepidocolaptes angustirostris coronatus
Casiornis rufa
Xolmis cinerea
" velata
Suiriri affinis

Mimus saturninus	Sporophila leucoptera mexianae
Turdus amaurochalinus	" bouvreuil
Archiplanus solitarius	" caerulescens
Agelaius cyanopus	

Returning now to the question of ecological habitats, Snethlage (Journ. f. Ornith., 61, 1913, pp. 469–539) gives the following classification.

I. Low land subject to flooding in the rainy season—the *varzea* of the Brazilians.
   a. Virgin forest
   b. Savannahs or *campos*
II. High ground never flooded
   a. Virgin forest
   b. Savannahs or *campos*
III. Scrub growth of at least two types, caused by the destruction of the original forest, the *capoeira*.

One point to emphasize here is the almost incredibly minute differences in habitat which affect the presence or absence of many humid tropical forest birds. Some like the two species of *Automolus* and the flycatchers, *Knipolegus* and *Phacotriccus*, are strictly riparian. The little *Sicalis columbiana goeldii* is practically confined to grassy patches on river banks. The virgin forest can be divided into at least four "associations:" (1) the ground floor (2) the undergrowth and shrubbery (3) the trunks and lower branches (4) the "crown" or tops of the trees, where recent studies in British Guiana have proved the occurrence of a special insect fauna. While many birds will be found in two or more of these divisions, some are strictly confined to each one. The same divisions apply to the *varzea* forest. Here a fascinating problem presents itself—what becomes of the birds of the first two divisions during the season of flood?

As the rivers are the highways of travel, and the principal cities and towns are on the rivers, it follows that the *varzea* birds are much better known and more abundantly represented in collections. Comparatively few expeditions have penetrated to points up the rivers to high ground and have stayed there any length of time. The rarity of many "high ground" forest species will prove to be more apparent than real.

With hundreds of species of birds, however, there is as yet little or nothing on record as to their habitat preferences and seasonal changes in preference, if any. In other cases, botanical knowledge runs ahead

of the ornithological. Near Jamundá, Rio Faro, for instance, are stretches of grassy sand dunes with special trees and shrubs. It would be difficult, if not impossible, to produce a list of birds characteristic of this habitat.

Of very great importance in the distribution of the birds are the topographic boundaries provided by the main Amazon and its principal tributaries. Many decades ago people began to be aware that certain birds like the Trumpeters would not cross a river. But our knowledge today of the degree to which birds are sedentary in tropical forests is greatly increased. The Ant-birds furnish an excellent illustration of innumerable subspecies, the ranges of which are confined to the area between two great rivers. There are, however, many exceptions and anomalies, and in certain cases birds are crossing the Amazon between Obidos and Santarem and further up river near Villa Bella Imperatriz; common on one bank, they are rare and little known on the other, where they would appear to have gained a bare "toe-hold" only. The following principal groups can be distinguished.

1. Species of the Guianas south to the north bank of the Amazon. In a small number of cases they cross this river at its mouth and occur near Pará, but do not range very far up-river on the south side.

2. A group of representative species on the south side of the Amazon balances group 1 in part.

3. Genera and species of far upper Amazonia range eastward down river for varying distances. Many stop at the Rio Madeira, others reach the left bank of the Rio Tapajoz. Many stop at the Rio Negro on the north side.

4. A group of representative species and subspecies on the south bank in Lower Amazonia balances group 3 in part.

5. Many species range much more widely, from the Guianas to eastern Brazil or farther. When subspecific variation occurs, the main Amazon is the usual boundary. In other cases the population in the Amazon valley is intermediate, but sufficiently distinct from either extreme to bear a separate name. The modern tendency is to name all these intermediate populations.

6. A small group of endemic species, practically confined to our area on the south side of the Amazon, not clearly representative of anything else. Examples are *Pyrrhura rhodogaster, Conopophaga roberti,* and *Pipra iris.*

7. It follows that the greatest number of endemic species and subspecies occur on the south bank in our area.

8. These various groups clearly fit in to the concept of an Amazonian

Sea in the past. A relatively recent area has been invaded from the north, west, and south, and the invasion may still be going on.

9. The enormous avifauna is due to the sedentary nature of many of the birds, the bounding effects of the great rivers, and the ability of the birds to adapt themselves to relatively minute ecological habitats.

In the systematic list beyond we have been careful to point out all cases where birds belong to one or another of these groups.

As a matter of interest a list of the known migrants and winter visitants is appended. Many Shore-birds, the Gray-cheeked Thrush, the Blackpoll and Connecticut Warblers and Bobolink migrate across the Amazon west of our area. They are perhaps following an ancestral route west of the Amazonian Sea.

MIGRANTS OR WINTER VISITANTS

Pelecanus occidentalis	from the north
Phoenicopterus ruber	"
Pandion haliaëtus carolinensis	"
Falco peregrinus anatum	"
Haematopus ostralegus palliatus	"
Pluvialis dominica	"
Squatarola squatarola	"
Charadrius semipalmatus	"
" *wilsonia*	"
Bartramia longicauda	"
Numenius hudsonicus	"
Tringa flavipes	"
" *melanoleucus*	"
" *solitaria*	"
Actitis macularia	"
Catoptrophorus semipalmatus	"
Arenaria interpres morinella	"
Limnodromus griseus	
Crocethia alba	"
Ereunetes pusillus	"
Erolia minuta	"
" *fuscicollis*	"
" *melanotos*	"
Larus atricilla	"
Gelochelidon nilotica	"

Sterna hirundo	from the north
" *antillarum*	"
Muscivora tyrannus tyrannus	south
? *Tyrannus albogularis*	"
" *m. melancholicus*	"
? *Empidonomus varius varius*	"
? " *aurantio-atro-cristatus minor*	"
Myiodynastes maculatus solitarius	"
Empidonax euleri	"
Progne subis subis	north
Pygochelidon cyanoleuca	south
Riparia riparia	north
Hirundo erythrogaster	"
Vireo chivi chivi	south
" " *vividior*	north
" *calidris barbatula*	"
Dendroica aestiva aestiva	"

SYSTEMATIC LIST

Family TINAMIDAE

1. Tinamus tao tao Temminck

Type locality: Pará

Para, Cussary (Snethlage): Santarem (Chapman & Riker); Santarem & Rio Tapajoz (Pinto)

1 ♂, 1 ♀ 1? Rio Tapajoz; 1 ♂, Rio Capim

1 ♂, Apaçy, Rio Tapajoz (Carnegie Museum)

A widely ranging, but little known Tinamou, with a relatively restricted Amazonian range. Pinto records this species from Monte Alegre on the north bank, but it might prove to be a different subspecies. The species reappears in Venezuela, but this apparently discontinuous distribution may not prove real.

2. Tinamus major major (Gmelin)

Type locality: Cayenne

Obidos (Snethlage, as *T. subcristatus*); Obidos (Conover & Pinto)

1 ♂ imm., 1 ♀, Obidos (Carnegie Museum)

These birds agree perfectly with Cayenne topotypes in the Carnegie Museum.

3. Tinamus major olivascens Conover, 1937

Type locality: Toure-Assu, Rio Acará, Pará

Rio Acará and Rio Tapajoz, left bank (Conover); right bank (Pinto, as *serratus*)

1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

Apparently a rare bird on the south bank of the Amazon in our area. It would appear to be commoner on the Rio Purus. Two specimens from there agree with the Tapajoz bird and fully support Conover's conclusions on this very distinct race. Birds from the Rio Madeira would presumably belong here also, though they pass as *serratus* (Spix); but Hellmayr's detailed comments in his study of Spix's types shows clearly that they cannot possibly be *olivascens* Conover. It is obvious that this group requires further study. At present two races have a discontinuous distribution and stagger each other in four river valleys on the south bank of the Amazon.

4. Tinamus guttatus Pelzeln

Type locality: Borba, Rio Madeira

Marajo Island (Hellmayr); vicinity of Pará (Hellmayr, Snethlage, Stone); Santarem (Chapman & Riker)

1 ♀, Benevides, 2 ♂, Santarem, 2 ♀, Rio Tapajoz, left bank (Carnegie Museum).

This species is also known from far upper Amazonia, where specimens should prove separable, judging by Salvadori's comments. (Cat. Birds Brit. Mus., **27**, p. 508).

There is still an interesting problem in the life histories of these big Tinamous. No one seems to know how they divide the territory between them.

5. Crypturellus cinereus (Gmelin)

Type locality: Cayenne

Monte Alegre (Snethlage); Marajo Island (Snethlage); vicinity of Pará (numerous collectors); Santarem (Chapman & Riker)

1 ♀, Benevides; 2 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

A relatively rare species, reaching its southern limits on the south bank of the Amazon.

6. Crypturellus obsoletus griseiventris (Salvadori)

Type locality: Santarem
Reported only from the type locality, and Caxiricatuba, Rio Tapajoz (Pinto)
1 ♂, Rio Tapajoz, Pinhy
3 ♂ 4 ♀, Santarem (Carnegie Mus.)

A rare and little known subspecies of a widely ranging species from central Brazil southward.

7. Crypturellus soui soui (Hermann)

Type locality: Cayenne
Rio Jamundá (Faro), Cussary, Obidos (Snethlage); Obidos (Pinto)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)

The Carnegie Museum possesses 1♂ 3♀ from French Guiana, which definitely represent typical *soui*. The two birds from Obidos agree with these in that the female especially is a very rich tawny, rufescent and buffy bird, and *soui* would appear to be the extreme in this direction of all the South American races.

8. Crypturellus soui decolor Griscom and Greenway, 1937

Type locality: Pinhy, right bank Rio Tapajoz, Pará
Pará (Elliott) in Brit. Mus.); numerous localities near Pará (Hellmayr, Snethlage, Stone, Pinto as *soui*); Boim, Rio Tapajoz (Snethlage); Santarem (Chapman & Riker)
1 ♂, Rio Tapajoz, Pinhy
1 ♂, Benevides, 3 ♂ 1 ♀, Santarem, 2 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

As pointed out in our original description Hellmayr had already characterized this subspecies, but lack of typical *soui* made it impossible for him to go further. It proves to be strikingly different from typical *soui* in that both sexes are duller colored, less tawny above; the female paler and more ochraceous, less tawny below; males, as usual, less different than females, but greyer and browner, less buffy and ochraceous.

There are still many complications and uncertainties, however, in the variations of this species in most of Amazonia. By inference only from Hellmayr's comments, British Guiana specimens are not quite the same thing as typical *soui*. Further extended comments by him on birds from both banks of the Rio Madeira show clearly that these

birds have nothing to do with *decolor*, but differ from British Guiana specimens only in the color of the upper tailcoverts. They have since been described as *hoffmannsi* Brabourne and Chubb, type from the left bank. It will be apparent, therefore, that there may well be one or possibly two valid subspecies here, when real series can be combined, and that specimens from the north bank of the Amazon from Faro might be one or another of these subspecies, rather than *soui*. Further uncertainties develop as we proceed westward. Specimens from the Rio Purus in the Carnegie Museum are once more dull and pale like *decolor*, but on the Rio Solimoes we find another rich tawny bird, exceedingly close to *soui!*

It should now be clear why we are not rash enough to refer Rio Purus specimens to *decolor*. It is certainly striking that the variations indicated are exactly the same geographically as those pertaining to *Tinamus major*.

9. Crypturellus undulatus adspersus (Temminck)

Type locality: State of Pará, Brazil

"Pará" (old specimens in Mus. Berlin and Monaco, fide Hellmayr); Rio Maecuru and Rio Tapajoz (Snethlage); Rio Tapajoz (Pinto)

1 ♂ 1 ♀, Rio Acará, Buenos Aires

1 ♂ 3 ♀, Rio Tapajoz, Pinhy and Tauary (do.)

3 ♂, Santarem (Carnegie Mus.)

1 ♂ 1 ♀, Miriti tuba and Goyana Isl., Rio Tapajoz (do.)

This subspecies is the northeasternmost of the many races of *undulatus*, ranging north to the upper Rio Branco and southern British Guiana, and west to the Rio Madeira. The species is primarily one of campos country or savannahs rather than heavy rain forest which accounts for its absence from the vicinity of Pará. According to Hellmayr, birds from Borba on the right bank of the Rio Madeira are practically identical with Temminck's type. Our two birds from the Rio Acará, the easternmost point of definite record, are more heavily barred on the neck than the Tapajoz series.

Madame Snethlage recorded *japura* (Spix) from the Rio Tapajoz erroneously. It is not known east of the Rio Solimoes. From the left bank of the Rio Madeira to the Rio Purus, we find *confusus* Brabourne and Chubb. Seven specimens in the Carnegie Museum are more heavily barred and vermiculated with blackish above, and on the average somewhat greyer, less buffy, on flanks and under tailcoverts.

10. Crypturellus variegatus variegatus (Gmelin)

Type locality: Cayenne
Obidos (Hellmayr, Snethlage)
1 ♂ 2 ♀, Obidos (Carnegie Mus.)

11. Crypturellus variegatus transamazonicus Todd, 1937

Type locality: Santarem, Brazil
Vicinity of Pará; numerous records (Natterer, Hellmayr, Snethlage); mouth of Rio Tapajoz (Pinto)
9, Santarem; Rio Tapajoz, left bank, 2 (Carnegie Mus.)

A very distinct subspecies, the separability of which was predicted by Hellmayr (Novit. Zoöl., 1905, p. 305), although some of the differences he noted are matters of age or individual variation. We are, of course, familiar with the material in the Carnegie Museum, the basis for Todd's valuable review of this species. To us, however, the birds from the Rio Purus and Rio Solimoes are just half way between the present form and *salvini* of east Ecuador, and we would not refer them to *transamazonicus* for a moment. They may well be left uncertain, until the type of variation on the Rio Madeira becomes known.

12. Crypturellus noctivagus erythropus (Pelzeln)

Type locality: Manaos, as restricted by Zimmer, 1938
Obidos (Hellmayr, Zimmer, Pinto); Rio Jamundá, Faro Snethlage, Zimmer)
10 ♂, Obidos (Carnegie Mus.)

The series in the Carnegie Museum had enabled us to reach the identical conclusions, just published by Zimmer, 1938, which show that *dissimilis* Salvadori from British Guiana is a synonym.

13. Crypturellus noctivagus strigulosus (Temminck)

Type locality: Pará
Near Pará; numerous localities (Natterer, Goeldi, Hellmayr, Snethlage, Stone, Pinto); Rio Acará (Snethlage); Rio Tapajoz (Pinto); Rio Tocantins and Rio Xingú (Zimmer)
1 ♂ 2 ♀ ad., 1 ♀ imm., Rio Tapajoz, Pinhy
2 ♂ 1 ♀ ad., 1 ♂ juv., Santarem (Carnegie Mus.)
2 ♂, Rio Tapajoz (do.)

By now a relatively well known Tinamou, ranging to the right bank

of the Rio Madeira. Westward it is replaced by *hellmayri* Brabourne and Chubb on the left bank of the same river, a subspecies still practically unknown. The species is apparently lacking on the Rio Purus and the Rio Solimoës, and on the north bank of the Amazon, west of the Rio Negro.

14. Crypturellus parvirostris (Wagler)

Type locality: Bahia, suggested by Hellmayr
Marajo Island (Snethlage); Santarem (Chapman and Riker).
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

A characteristic species of the "campo" of central and southern Brazil, locally penetrating north to the south bank of the Amazon.

15. Rhynchotus rufescens catingae Reiser

Type locality: Rio Parnahyba, Piauhy
One specimen from Marajo Island (Pinto Peixoto, 1923)

This record would appear to have been completely overlooked. The bird is referred to *catingae* on purely geographic grounds; the validity of the subspecies has been questioned, at least in part (cf. Pinto, 1938).

Family COLYMBIDAE

16. Poliocephalus dominicus speciosus (Arribalzaga)

Type locality: Buenos Aires
Cajutuba near Pará (Natterer); Monte Alegre near Pará (Snethlage)
1 ♀, Rio Tapajoz, Santarem (M.C.Z.)

Family PHALACROCORACIDAE

17. Phalacrocorax olivaceus olivaceus (Humboldt)

Type locality: near Banco, Rio Magdalena, Colombia
Marajo Island (Snethlage); Ucuritubа, near Santarem (Hellmayr); Cajutuba near Pará (Natterer, Graham)
1 ♂ ad., Tapajoz River, Santarem

Family ANHINGIDAE

18. Anhinga anhinga anhinga (Linnaeus)

Type locality: Brazil
Rio Capim near Pará (Hellmayr); Marajo Island (Snethlage); Pará (Pinto). 2 ♂ ad., 2 ♂ imm., 1 ♀ ad., 1 ♀ imm., 1 ? imm.; Rio Tapajoz, various localities

The arrival of this series from Brazil, the type locality, with two others from the lower Amazon, made it possible to compare birds from the United States for the first time. These last prove to average smaller, with markedly shorter bills. There is also an excellent color character. Brazilian birds have a much broader tail tip, at least double that of North American birds, and on the outer tail feathers much more than this. Intergradation is about as follows. An east Ecuador specimen has a bill as long as Brazilian birds, but a short wing, and the tail tip is intermediate. Panama and Yucatan birds resemble Florida specimens in size, but have an intermediate tail-tip. Cuban birds are like Florida series.

As it is more than possible that extreme western and northwestern Brazilian birds might prove to be intermediate, like the east Ecuador bird discussed above, we designate Rio Tapajoz, Pará, Brazil as a restricted type locality. The northern race will be known as *Anhinga anhinga leucogaster* (Vieillot), type locality, Florida.

	♂	♀
Brazil —wing 340–353;	bill, 93–96	349 90.5
Florida—wing 322–345;	bill, 80–88	323–338; 75–87

Family PELECANIDAE

19. Pelecanus occidentalis occidentalis (Linnaeus)

Type locality: Jamaica
Itaituba, Rio Tapajoz (Snethlage)

A very surprising record, as the Brown Pelican is unknown in South America, except along the coast of Venezuela and the Guianas.

N.B. Frigate-Birds (*Fregata*) and Boobies (*Sula* ssp.) surely occur off the coast of Pará, but there are no definite records.

Family ARDEIDAE

20. Ardea cocoi Linnaeus

Type locality: Cayenne

Mexiana Island (Hagmann and Snethlage); Marajo Island (Pinto-Peixoto); Pataua and Lago Cuipeua (Pinto)

1 ♂ ad., Rio Tapajoz (M. C. Z.)

2 ♀ , Lago Grande (do.)

21. Casmerodius albus egretta (Gmelin)

Type locality: Cayenne

Rio Capim (Goeldi); Mexiana Island (Hagmann and Snethlage); Santarem (Chapman and Riker, Marajo Island (Pinto-Peixoto)

2 ♂, Rio Amazon, Lago Jauary, Livramento (M.C. Z.)

1 ♀, Rio Tapajoz, Santarem (do.)

22. Leucophoyx thula thula (Molina)

Type locality: Chili

Mexiana Island (Hagmann and Snethlage); Santarem (Chapman and Riker)

1 ♂, R. Amazon, Lago Jauary (M. C. Z.)

23. Florida caerulea (Linnaeus)

Type locality: Carolina

Mexiana Island (Hagmann and Snethlage); Marajo Island (Snethlage); Pataua and Lago Cuipeua (Pinto)

1 ♂ imm., R. Amazon, Lago Jauary (M. C. Z.)

1 ♂ ad., R. Amazon, Lago Jauary (do.)

1 ♀ ad., R. Amazon, Lago Grande (do.)

24. Hydranassa tricolor tricolor (P.L.S. Muller)

Type locality: Cayenne

Cajutuba, near Pará (Natterer); Capanema (Snethlage)

1 ♂, R. Amazon, Boca do Igarape Piaba (M. C. Z.)

25. Agamia agami (Gmelin)

Type locality: Cayenne
Pará (Layard and Snethlage); Monte Alegre (Snethlage); Rio Tapajos (Snethlage)

Specimen A ♂, B ♂, R. Tapajoz, Pinhy (May) (M. C. Z.)
Specimen C ♂ R. Tapajoz, Caxiricatuba (July) (do.)
Specimen D ? R. Tapajoz, Tauary (Oct.) (do.)
Specimen E ♂ R. Tapajoz, Tauary (Nov.) (do.)
Specimen F ♂ R. Tapajoz, Tauary (Aug.) (do.)
G imm. ♂, R. Tapajoz, Pinhy (do.)
H imm. ♂, R. Amazonas, Lago Grande (do.)
1 ♀ imm., Santarem (Carnegie Mus.)

Specimens C and E are very much bluer and less green on the back and wing coverts than other adult specimens. It would seem probable that there is an intermediate stage of plumage which is characterized by the green back. A specimen from middle America in the collections of the Museum of Comparative Zoology has new blue feathers molting in on the back, while the greener feathers remaining on the upper back appear to be falling out.

Specimen F has the brown underparts streaked with buff.

26. Nycticorax nycticorax hoactli (Gmelin)

Type locality: Valley of Mexico
Pará; Marajo and Mexiana Islands (all Snethlage)

1 ♂ imm., R. Amazon, Lago Jauary (M. C. Z.)
1 ♀ R. Amazon, Lago Jauary (do.)

27. Nyctanassa violacea cayennensis (Gmelin)

Type locality: Cayenne
Marajo Island (Snethlage)

28. Pilherodius pileatus (Boddaert)

Type locality: Cayenne
Mexiana Island (Hagmann and Snethlage); Monte Alegre (Snethlage)

1 imm. ♀, R. Tapajoz, Caxiricatuba (Aug.) (M. C. Z.)

The wings are whiter, not as gray, and the feathers of the neck not as long or as decomposed as the mature bird.

29. Butorides striatus striatus (Linne)

Type locality: Surinam

Pará (Stone); Rio Capim (Goeldi); Mexiana Island (Hagmann); numerous localities from Pará to the mouth of the Amazon (Snethlage); Santarem (Chapman and Riker)

A long series from Rio Tapajoz

1 ♂ Santarem (Carnegie Mus.)

30. Tigrisoma lineatum lineatum (Boddaert)

Type locality: Cayenne

Pará (Layard and Hellmayr); Rio Capim (Goeldi); Mexiana Island (Hagmann) Ilha das Oncas and Marajo Island (Snethlage); Monte Alegre (Snethlage); Santarem (Chapman and Riker)

1 ♂ R. Amazonas, Lago Jauary, Livramento (M. C. Z.)

1 ♂ R. Amazonas, Boca do Igarape Piaba (do..)

1 ♀, Santarem (Carnegie Mus.)

31. Ixobrychus exilis erythromelas (Vieillot)

Type locality: Paraguay

Pará, Marajo Island, Monte Alegre, Cussary (Snethlage)

1 ♂, Santarem (Carnegie Mus.)

32. Zebrilus undulatus (Gmelin)

Type locality: Cayenne

Pará, Rio Tocantins (Aramatheua), Cussary, Rio Jamundá (Faro), all Snethlage; Santarem (Chapman and Riker), Pará (Pinto)

2 ♂, Obidos; 1 ♂, Santarem (Carnegie Mus.)

33. Botaurus pinnatus (Wagler)

Type locality: Bahia

1 ♂, Rio Tapajoz, Tauary (M. C. Z.)

This specimen has the brown streaks on the neck and upper breast somewhat lighter than two specimens from Colombia in this museum.

This rare bittern has never before been recorded from Amazonian Brazil.

Family COCHLEARIIDAE

34. Cochlearius cochlearius cochlearius (Linnaeus)

Type locality: Guiana
Rio Capim (Goeldi); Mexiana Island (Hagmann and Snethlage); near Pará (Snethlage-Stone); Marajo Island (Snethlage); Rio Tocantins, Cametá (Snethlage); Utinga and Lago Cuipeua (Pinto)
1 ♂, R. Amazon, Lago Jauary, Livramento (M. C. Z.)

Family CICONIIDAE

35. Mycteria americana Linnaeus

Type locality: northeastern Brazil
Mexiana Island (Hagmann); Marajo Island (Snethlage)

36. Euxenura galeata (Molina)

Type locality: Chile
Mexiana Island (Hagmann); Marajo and Mexiana Islands (Snethlage)

37. Jabiru mycteria (Lichtenstein)

Type locality: Brazil, *ex* Marcgrave
Mexiana Island (Wallace and Hagmann); Marajo Island (Snethlage)

Family THRESKIORNITHIDAE

38. Theristicus caudatus caudatus (Boddaert)

Type locality: Cayenne
Mexiana Island (Hagmann); Marajo and Mexiana Islands (Snethlage), Lago Cuipeua (Pinto)

39. Mesembrinibis cayennensis (Gmelin)

Type locality: Cayenne
Mexiana Island (Hagmann and Snethlage); Rio Tapajoz, Goyana (Snethlage)
1 ♀, Rio Acará, Acará (M. C. Z.)
4 ♂ 1 ♀, Rio Tapajoz, Caxiricatuba and Tauary (do.)

40. Phimosus infuscatus nudifrons (Spix)

Type locality: Rio Sao Francisco, Brazil
Rio Inhangapy (sight record by Bond and de Schauensee) Stone, 1928

41. Guara rubra (Linnaeus)

Type locality: Guiana
Cajutuba, near Pará (Natterer); Mexiana Island (Hagmann and Snethlage); Marajo Island (Hellmayr, Pinto, and Snethlage)

42. Ajaia ajaja (Linnaeus)

Type locality: South America
Cajutuba, near Pará (Natterer); Mexiana Island (Hagmann); Marajo Island (Snethlage)

Family PHOENICOPTERIDAE

43. Phoenicopterus ruber Linnaeus

Type locality: Jamaica
Cajutuba (Natterer); Macapá, 1 ♀ 3 ?, collected by J. de Cavianna (Snethlage)

Family ANHIMIDAE

44. Anhima cornuta (Linnaeus)

Type locality: Brazil
Rio Maracana, Livramento, and Peixe-Boi (Snethlage); near Pará (Stone, sight record)
1 ♀, Obidos (Carnegie Mus.)

Family ANATIDAE

45. Cairina moschata (Linnaeus)

Type locality: Brazil
Rio Capim (Goeldi); Mexiana Island (Hagmann); Marajo Island (Snethlage); Cunany (Snethlage); Santarem (Chapman and Riker)

46. Sarkidiornis sylvicola Ihering

Type locality: Brazil
Atlantic coast of Marajo Island and Maguary (Goeldi)

47. Dendrocygna viduata (Linnaeus)

Type locality: Cartagena, Colombia
Marajo Island (Goeldi)

48. Dendrocygna bicolor bicolor (Vieillot)

Type locality: Paraguay
Marajo Island (Goeldi and Snethlage); Maguary (Goeldi)

49. Dendrocygna autumnalis discolor Sclater and Salvin

Type locality: Maroni River, Surinam
Marajo Island (Hellmayr and Snethlage); Mexiana Island (Hagmann); Pará (Pelzeln); Obidos (Hellmayr); Santarem (Chapman and Riker); Lago Cuipeua (Pinto); Caviana Island (Brodkorb)
3 ♂ 3 ♀, Rio Tapajoz, Pinhy and Caxiricatuba (M. C. Z.)
1 ♀, Santarem (Carnegie Mus.)

50. Neochen jubata (Spix)

Type locality: Rio Solimoes, Brazil
Mexiana Island (Hagmann)
1 ♂, Santarem (Carnegie Mus.)

51. Anas brasiliensis Gmelin

Type locality: Brazil
Pará (Snethlage); Marajo Island (Goeldi and Snethlage)
1 ♂, Rio Capim, Pará (M. C. Z)
2 ♂, Rio Acará, Acará (do.)
2 ♂, Rio Tapajoz (do.)
1 ♂, north bank of Amazon near Obidos (do.)
8 ♂ 1 ♀, Apaçy, Rio Tapajoz (Carnegie Mus.)

52. Anas bahamensis Linnaeus

Type locality: Bahamas
Cajutuba, near Pará (Natterer); Marajo Island (Goeldi)

53. Nomonyx dominicus (Linnaeus)

Type locality: South America
Rio Acará (Snethlage)

Family CATHARTIDAE

54. Sarcorhamphus papa (Linnaeus)

Type locality: Brazil
Pará (Goeldi); Rio Maracá (Snethlage); Santarem (Chapman and Riker)

55. Coragyps atratus foetens (Lichtenstein)

Type locality: Paraguay
Pará (Wallace, Layard, Snethlage, Stone); Rio Capim (Goeldi); Mexiana Island (Hagmann)

56. Cathartes aura ruficollis Spix

Type locality: Interior of Bahia and Piauhy
Pará (Snethlage); Marajo Island (Snethlage); Mexiana Island (Hagmann and Snethlage); Santarem (Chapman and Riker)
1 ♀, Rio Tapajoz, Tauary; 1 ♂ Santarem (Carnegie Mus.)

57. Cathartes urubitinga Pelzeln

Type locality: Southern and central Brazil
Rio Capim (Goeldi); Marajo Island (Snethlage); Pará, Rio Guamá and Rio Inhangapy (Stone); Caviana Island (Brodkorb).

Family ACCIPITRIDAE

58. Elanoides forficatus yetapa (Vieillot)

Type locality: Paraguay
Pará (Layard and Natterer); Rio Capim (Goeldi); Peixe-Boi and Quati-puru (Snethlage); Mexiana Island (Hagmann); near Santarem (Hellmayr)

59. Odontriorchis palliatus (Temminck)

Type locality: Southern Bahia
Pará and Marajo Island (Snethlage); Rio Acará (Hellmayr); Santarem (Chapman and Riker, Pinto)
1 ♂ 1 ♀, Rio Tapajoz, Pinhy and Tauary (M. C. Z.)

60. Chondrohierax uncinatus (Temminck)

Type locality: near Rio
1 ♀, Rio Tapajoz, Tauary (M. C. Z.)

61. Harpagus bidentatus bidentatus (Latham)

Type locality: Cayenne
Mexiana Island (Hagmann); Pará, Marajo Island, Rio Tocantins, and Rio Tapajoz, (Snethlage); Obidos (Hoffmans); Utinga (Pinto)
1 ♂ 1 ♀, Rio Amazonas, Lago Cuipeuz (adults) (M. C. Z.)
2 ♂ 3 ♀, Rio Tapajoz, Tauary (immature) (do.)
2 ♂ ad. 1 ♂ imm., Obidos (Carnegie Mus.)
1 ♂ imm., Santarem (Carnegie Mus.)

This nicely sexed series shows some color differences between the two sexes when immature. Current descriptions apply to the female primarily. The male is much less marked below, the black streaks, rather than spots, confined to the chest except for fine shaft streaks on the central feathers of breast and abdomen.

62. Harpagus diodon (Temminck)

Type locality: "Bresil"
Pará (Hellmayr); Pará and Rio Capim (Goeldi); Santarem (Chapman and Riker)
1 ♂, Apaçy, Rio Tapajoz (Carnegie Mus.)

All recent check-lists overlook these records, and restrict the range of this species to eastern and southeastern Brazil.

63. Ictinia plumbea (Gmelin)

Type locality: Cayenne
Pará (Wallace); Peixe-Boi (Hellmayr); San Antonio do Prata (Snethlage); Rio Tocantins, Arumatheua (Snethlage)

64. Rostrhamus sociabilis sociabilis (Vieillot)

Type locality: Corrientes
Pará (Stone); Peixe-Boi, Marajo Island, Rio Tocantins (Arumatheua); all Snethlage; Santarem (Chapman and Riker)
1 ♀, Rio Tapajoz, Pinhy (M. C. Z.)

65. Helicolestes hamatus (Temminck)

Type locality: Brazil
Pará (Snethlage)
4 ♂ 1 ♀, Obidos (Carnegie Mus.)

66. Elanus leucurus leucurus (Vieillot)

Type locality: Paraguay
Marajo Island (series, Snethlage)

67. Accipiter bicolor bicolor (Vieillot)

Type locality: Cayenne
San Antonio, near Pará (Hellmayr); Bemfica (Steere); Santarem (Chapman and Riker)
1 ♂, Santarem (Carnegie Mus.)

68. Accipiter pectoralis (Bonaparte)

Type locality: Brazil
Pará, 1 ♀ (Snethlage)

69. Accipiter superciliosus superciliosus (Linnaeus)

Type locality: Surinam
Pará (Natterer and Stone); Benevides and Peixe-Boi (Snethlage)
1 ♀, Rio Tapajoz, Santarem (M. C. Z.)

70. Heterospizias meridionalis meridionalis (Latham)

Type locality: Cayenne
Mexiana Island (Wallace, Hellmayr and Snethlage); Marajo Island (Snethlage); Rio Xingú, Victoria (Snethlage); Santarem (Chapman and Riker)

71. Buteo albicaudatus albicaudatus Vieillot

Type locality: Rio de Janeiro
Marajo Island (Snethlage); also by Brodkorb as *colonus* Berlepsch
1 ♂, Rio Tapajoz, Tauary (M. C. Z.)

The two subspecies meet in our area, and perhaps birds will prove to vary individually towards both.

72. Buteo albonotatus abbreviatus Cabanis

Type locality: Pomeroon River, British Guiana
Marajo Island (Snethlage)

73. Buteo brachyurus Vieillot

Type locality: Cayenne
Pará (Natterer); Nazaré (Layard)

74. Buteo magnirostris magnirostris (Gmelin)

Pará (Spix, Layard, Stone, Snethlage); Cajutuba (Natterer); Rio Capim (Goeldi); Mexiana Island (Wallace, Hagmann and Snethlage); Marajo Island (Snethlage); Santarem (Chapman and Riker); Obidos (Hellmayr); Caviana Island (Brodkorb)

1 ♂ 1 ♀, Rio Tapajoz, Tauary (M. C. Z.)
1 ♂, Rio Tapajoz, Caxiricatuba (do.)
1 ♀, Rio Amazonas, Lago Cuipeuz (do.)
1 ♀, Rio Amazonas, Boca do Igarapé Piaba (do.)
2 ♀, Obidos and 1 ♂ 2 ?, Santarem (Carnegie Mus.)

This series is readily referable to the typical race, but differs from a fine series from Surinam in averaging far more rufescent below, thereby approaching *nattereri* (Sclater and Salvin) to some extent. On geographical grounds this is to be expected, as Hellmayr (Orn. of Northeastern Brazil, p. 460) refers birds from Maranhao and Ceará to *nattereri*.

75. Asturina nitida nitida (Latham)

Type locality: Cayenne

Pará (Natterer, Snethlage, Stone); San Antonio (Hellmayr); Peixe-Boi, Arapiranga and Marajo Island (Snethlage); Santarem (Chapman and Riker); Rio Tapajoz (Pinto)

1 ♂ imm., Santarem (Carnegie Mus.)

76. Leucopternis albicollis albicollis (Latham)

Type locality: Cayenne

San Antonio (Hellmayr); Rio Capim and Rio Tocantins (Snethlage); Itaituba (Pinto)

1 ♂, Obidos (Carnegie Mus.)

77. Leucopternis melanops (Latham)

Type locality: Cayenne

Pará (Natterer)

1 ♂, Rio Amazonas, Lago Cuipeuz (M. C. Z.)
1 ♂, Obidos (Carnegie Mus.)

78. Leucopternis kuhli Bonaparte

Type locality: Pará

Pará (Natterer and Wallace); San Antonio (Hellmayr); Igarape-Assu (Hellmayr); Peixe-Boi (Snethlage); Rio Tapajoz (Pinto)

1 ♀, Villa Braga, Rio Tapajoz (Carnegie Mus.)

79. Leucopternis schistacea (Sundevall)

Type locality: Brazil
Rio Capim (Goeldi); Pará, Maracá (Snethlage)
1 ♂, Benevides, Pará (Carnegie Mus.)

80. Hypomorphnus urubitinga urubitinga (Gmelin)

Type locality: Brazil
Rio Capim, Pará (Goeldi); Mexiana Island (Wallace, Hagmann, Snethlage); Marajo Island, Maracá, Cussary (Snethlage); Santarem (Chapman and Riker, Pinto); Pataua (Pinto)
4 ♂, Rio Tapajoz, Boim and Caxiricatuba (M. C. Z.)

81. Buteogallus aequinoctialis (Gmelin)

Type locality: Cayenne
Cajutuba (Natterer); Marajo Island (Snethlage)

82. Busarellus nigricollis nigricollis (Latham)

Type locality: Cayenne
Mexiana Island (Wallace, Hagmann); Marajo Island and Cussary (Snethlage); Santarem (Chapman and Riker); Obidos (Hellmayr); Urucurituba (Hellmayr); Pará (Stone); Pataua, Lago Cuipeua (Pinto)
1 ♀, Lago Grande (M. C. Z.)

83. Harpia harpyja (Linnaeus)

Type locality: Mexico
Pará (Natterer); Castanhal (Stone); Peixe-Boi, Rio Guama, Rio Capim, Rio Tapajoz (Snethlage)

84. Spizastur melanoleucus (Vieillot)

Type locality: Guiana
1 ♂, Rio Tapajoz, Tauary (M. C. Z.)
1 ♂, Obidos (Carnegie Mus.)

Apparently the only records for the Amazon Valley.

85. Spizaëtus ornatus (Daudin)

Type locality: Cayenne
Santarem (Natterer, Chapman and Riker)
1 ♂, Rio Tapajoz, Tauary (M. C. Z.)

86. Spizaëtus tyrannus (Wied)

Type locality: Bahia, Brazil
Pará (Layard); Rio Capim (Wallace); Marajo Island and Rio Jamauchim (Snethlage)
1 ♂, Villa Braga, Rio Tapajoz (Carnegie Mus.)

87. Circus buffoni (Gmelin)

Type locality: Cayenne
Santarem (Natterer); Marajo Island (Snethlage)

88. Geranospiza caerulescens (Vieillot)

Type locality: Cayenne
Marajo Island and Rio Cussary (Snethlage); Santarem (Chapman and Riker)
1 ♀, Rio Amazonas, Lago Jauary (M.C.Z.)
1 ♀, Obidos (Carnegie Mus.)

Birds from the south bank may prove referable to *gracilis* (Temminck).

89. Pandion haliaëtus carolinensis (Gmelin)

Type locality: Carolina
Marajo Island (Snethlage)
1 ♂, Rio Tapajoz, Santarem, Oct. 17, 1932 (M. C. Z.)

Family FALCONIDAE

90. Herpetotheres cachinnans cachinnans (Linnaeus)

Type locality: Surinam
Mexiana Island (Wallace, Hagmann, Snethlage); Marajo Island (Snethlage); Rio Inhangapy (Stone); Santarem (Natterer); Caviana Island (Brodkorb).
1 ♀, Rio Amazonas, Boca do Igarapé Piaba (M. C. Z.)
1 ♂, Obidos (Carnegie Mus.)

91. Micrastur semitorquatus semitorquatus (Vieillot)

Type locality: Paraguay
Monte Alegre (Snethlage); Santarem (Pinto)
1 ♂ ad., Rio Amazonas, Lago Cuipeuz (M. C. Z.)
1 ♂ imm., Rio Tapajoz, Caxiricatuba (do.)
1 ♀ imm., Rio Tapajoz, Tauary (do.)
1 ♂ imm., Santarem (Carnegie Mus.)

92. Micrastur mirandollei mirandollei (Schlegel)

Type locality: Surinam
Pará (Natterer); Rio Guamá, Ourem (Snethlage)
1 ♀, Rio Acará, Villa Acará, fully adult. (M. C. Z.)
1 ♀, Villa Braga, Rio Tapajoz (Carnegie Mus.)

93. Micrastur ruficollis gilvicollis (Vieillot)

Type locality: Cayenne
Pará (Natterer, Wallace, Stone); Pará, Rio Xingú (Victoria), Rio Curuá, Rio Jary (Snethlage)
1 ♂, Rio Tapajoz, Tauary (M. C. Z.)
1 ♂, Obidos (CarnegieMus.)
1 ♂ 1 ♀, Benevides (do.)
2 ♀, Villa Braga, Rio Tapajoz (do.)

94. Daptrius ater Vieillot

Type locality: Brazil
Pará (Wallace); Cussary and Rio Jaumachim (Snethlage); Santarem (Pinto)
3 ♂ 1 ♀, Rio Tapajoz, Caxiricatuba (do.)
1 ♀, Rio Tapajoz, Pinhy
1 ♂, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)

One of these specimens is immature and represents *Gymnops fasciatus* Spix.

95. Daptrius americanus americanus (Boddaert)

Type locality: Cayenne
Pará (Wallace, Stone); Rio Capim (Goeldi); Peixe-Boi, Rio Guamá, Rio Moju, Rio Jamauchim (Snethlage)
1 ♂, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)

96. Milvago chimachima chimachima (Vieillot)

Type locality: Paraguay
Rio Capim (Goeldi); Mexiana Island (Wallace, Hagmann); Marajo Island (Snethlage); Santarem (Chapman and Riker)
1 ♀, Rio Tapajoz, Caxiricatuba (M. C. Z.)
1 ♂, Obidos (Carnegie Mus.)

97. Milvago chimachima paludivagus Penard

Type locality:
Amapá (Snethlage)
2 ♀, Boca do Igarapé-Piaba, near Obidos
1 ♂, Obidos (Carnegie Mus.)

These birds are really intermediate between the two subspecies. They are decidedly blacker above, like *paludivagus,* but only faintly buffier, less white below. We have no idea to which subspecies specimens from Mexiana and Marajo will prove to belong.

98. Polyborus plancus brasiliensis (Gmelin)

Type locality: Brazil
Mexiana Island (Wallace, Hagmann); Marajo Island (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)
1 ♀ ad., Rio Amazonas, Lago Grande (M. C. Z.)
1 ♂ 1 ♀ imm., Rio Tapajoz, Santarem (do.)

99. Gampsonyx swainsonii leonáe Chubb

Type locality: Leon, Nicaragua
Braganza, Monte Alegre, Cussary (Snethlage); Santarem (Chapman and Riker)
4 ♂ 4 ♀, Rio Tapajoz, Santarem (M. C. Z.)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂ , Santarem (do.)

This series agrees with a long series from Venezuela, British Guiana and Colombia in averaging more rufescent on thighs, flanks and sides than four birds from southeastern Brazil. The same slight average difference in the series in the American Museum of Natural History induced Miller and Griscom (Amer. Mus. Novit., no. 25, 1921, p. 13 and errata) to recognize two races in 1921 out of the three maintained by Swann at that time. Our series from the eastern Amazon is not typical of northern birds, one or two being practically indistinguishable from Bahia birds, and none as extreme as the most rufescent birds from Venezuela.

100. Falco peregrinus anatum Bonaparte

Type locality: New Jersey
Cajutuba, mangrove swamp, March, 1835 (Natterer)

101. Falco deiroleucus Temminck

Type locality: Santa Catharina, Brazil

Pará (Layard); Marajo Island (Snethlage); Santarem (Chapman and Riker, also Ribeiro)

1 ♀, Santarem (Carnegie Mus.)

102. Falco albigularis albigularis Daudin

Type locality: Cayenne

Pará (Hellmayr, Stone); Rio Capim (Goeldi); Peixe-Boi, Cunany, Rio Jamauchim (Snethlage); Santarem (Chapman and Riker); Obidos (Hellmayr)

1 ♂ 1 ♀, Rio Tapajoz, Boim and Caxiricatuba (M. C. Z.)

1 ♀, Obidos (Carnegie Mus.)

1 ♂ 1 ♀, Santarem (do.)

1 ♂, Villa Braga, Rio Tapajoz (do.)

It seems to us that *albigularis* Daudin applies definitely to this species.

103. Falco fuscocaerulescens fuscocaerulescens Vieillot

Type locality: Paraguay

Mexiana Island (Wallace, Hagmann); Marajo Island (Snethlage)

1 ♀, Rio Tapajoz, Santarem (M. C. Z.)

Family CRACIDAE

[Nothocrax urumutum (Spix)

This genus is characteristic of Upper Amazonia. The only record for our area is Snethlage's "Pará (in the zoological garden)". As Goeldi, however, states that the birds seen by him in the zoological garden at Pará came from the Rio Javary (in uppermost Amazonian Brazil), more satisfactory evidence of the occurrence of this curassow in our area is required.]

104. Mitu mitu (Linnaeus)

Type locality: northeastern Brazil

Pará (Natterer); Rio Capim (Goeldi); Rio Muraiteua (Stone); Rio Acará (Hellmayr)

2 ♂, Rio Tapajoz, Tauary (M. C. Z.)

1 ♂, Villa Braga, Rio Tapajoz (Carnegie Mus.)

This is the characteristic *Mitu* of the Guiana-Lower Amazonian region. On the Rio Negro northwestward it is replaced by *M. tomentosa* (Spix) and in Amazonian Ecuador by *M. salvini* (Reinhardt).

105. Crax nigra Linnaeus

Type locality: Guiana
Pataua and Cuipeua, on the north bank (Pinto)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)

This is apparently the only evidence to show that *nigra* ranges south to the Amazon. For that matter Dr. Oliveiro Pinto's record of *fasciolata* from Obidos is also the only evidence of that "species" on the north bank.

106. Crax fasciolata fasciolata Spix

Type locality: Pará, Brazil
Pará (Spix); Rio Capim (Goeldi); Obidos (Pinto)

107. Crax pinima Pelzeln

Type locality: Pará
Cajutuba (Natterer); Rio Capim (Goeldi)

Far too little is known about these two species of Crax, which are characteristic of Lower Amazonia. They are apparently replaced in upper Amazonia by *C. nigra* Linnaeus and *C. globulosa* Spix. By a remarkable piece of inadvertence the present species is omitted in Snethlage's Aves do Amazonas. She may, however, have thought that *pinima* was a pure synonym of *fasciolata*. Needless to say it is by no means certain that further material and study will endorse the validity of the four "species" here mentioned, or the identifications of some of them in our area.

108. Penelope marail (P.L.S. Müller)

Type locality: Cayenne
Rio Jamundá, Faro (Snethlage); near Obidos (Pinto)
1 ♂ 1 ♂ juv., 1 ♀, Obidos (Carnegie Mus.)

Apparently just reaching our area on the north bank of the Amazon. It should be expected elsewhere.

109. Penelope superciliaris superciliaris Temminck

Type locality: State of Pará, Brazil

Igarapé-Assu (Robert); Peixe-Boi and Ipitinga (Müller); Rio Capim (Goeldi); Rio Acará; Rio Tocantins, Arumatheua; Rio Tapajoz, Boim (all Snethlage)

5 ♂, 2 ♀, Rio Tapajoz, various localities (M. C. Z.)
1 ♀, Santarem (Carnegie Mus.)
1 ♂, 1 ♀, Villa Braga, Rio Tapajoz (do.)
1 ♂, Miriti tuba, do. (do.)

This is the characteristic *Penelope* of the south bank of the Amazon, west to the Rio Madeira. It is replaced by other races in central and southern Brazil, Paraguay and northeastern Argentina.

If Neumann's views as to the type locality of true *superciliaris* Temminck prove correct, this subspecies will be known as *pseudonyma* Neumann. (cf. Bull. Brit. Orn. Club, **53**, 1933, pp. 93–95.)

110. Penelope pileata Wagler

Type locality: State of Pará, Brazil

Pará (H. Sieber in Berlin Mus., and Natterer, cf. Pelzeln, pp. 283, 340); Monte Christo, Rio Tapajoz (Pinto)

1 ♂ 2 ♀, Rio Tapajoz, Tauary (M. C. Z.)

A little known species, apparently occurring in the same places with the two preceding, as it is recorded from the Rio Madeira and Manaos on the north bank.

111. Ortalis motmot motmot (Linnaeus)

Type locality: Cayenne

Obidos (Hellmayr, Pinto); Rio Maecuru, Monte Alegre (Snethlage)

5 ♂ 2 ♀, north bank of Amazon, Lago Cuipeuz (M. C. Z.)
1 ♂ ad., Obidos (Carnegie Mus.)

112. Ortalis motmot ruficeps (Wagler)

Type locality: State of Pará

Santarem (Chapman and Riker); Rio Tapajoz and Foz do Curuá (Pinto)

1 ♂, 3 ♀, Rio Tapajoz, Pinhy
1 ♂, 1 ♀, Rio Tapajoz, Tauary
6 ♂ 1 ♀, Santarem (Carnegie Mus.)
1 ♂, Miriti tuba, Rio Tapajoz (do.)

This fine series amply validates Peter's reduction of *ruficeps* to a race of *motmot*. A very interesting case, where the Amazon river is the boundary between two distinct subspecies.

113. Ortalis spixi Hellmayr

Type locality: Maranhao, Brazil

Pará, Rio Muria and Cajutuba (Natterer); Castanhal (Stone, sight record); Peixe-Boi and Ipitinga (Hellmayr); Rio Capim (Goeldi); Rio Tocantins, Mazagao (Snethlage)

1 ♂, Rio Capim, Resacca
1 ♀, Pará, Bosque
1 ♂ 1 ♀, Rio Acará, Acará
3 ♂ 2 ♀, Benevides (Carnegie Mus.)

While very distinct from *motmot*, it apparently represents it in easternmost Amazonia. Southward this group of the genus is replaced by *O. araucuan* (Spix). Further west we find a different section of the genus altogether, represented by *O. guttata* (Spix).

114. Ortalis guttata guttata (Spix)

Type locality: Rio Solimoës

1 ♂, Rio Tapajoz, Villa Braga (Carnegie Mus.)
1 ♂, (do.), Itaituba (do.)
2 ♂ 1 ♀, (do.), Apaçy (do.)

A range extension eastward from the Rio Madeira. These birds do not differ from a series from the Rio Solimoës and the Rio Purus.

115. Pipile pipile cujubi (Pelzeln)

Type locality: Pará

Pará (Natterer); Igarape-Assu (Hellmayr); Rio Capim (Goeldi); Rio Acará (Snethlage); Santarem (Chapman and Riker); Monte Alegre (Snethlage); Obidos (Pinto)

1 ♂, Rio Tapajoz, Miritituba (Carnegie Mus.)
1 ♀, (do.), Apaçy (do.), perhaps this species

Records from the north bank of the Amazon might be true *pipile*.

116. Pipile cumanensis subsp.

Santarem (Chapman and Riker); Rio Jamauchim, Santa Helena (Snethlage)

These records of this poorly known species were made long before any subspecies were proposed, none of which are alleged to occur in our area. The correctness of the identifications is questionable.

Family PHASIANIDAE

117. Odontophorus gujanensis gujanensis (Gmelin)

Type locality: Cayenne

Pará (Natterer); Rio Capim (Wallace and Goeldi); Igarape-Assu (Hellmayr); Peixe-Boi and Ipitinga (Hellmayr); Santarem (Chapman and Riker); Rio Tocantins, Mazagao; Cussary; Rio Tapajoz, Villa Braga and Boim; Rio Jamauchim, Santa Helena; all Snethlage as *marmoratus* (Gould)

5 ♂ 3 ♀, Rio Tapajoz, Tauary
2 ♀ , Obidos (Carnegie Mus.)
4 ♂ 4 ♀, Santarem (do.)
1 ♂ 3 ♀, Rio Tapajoz (do.)

This nice series is topotypical of *rufinus* (Spix), a name revived by Chubb for a lower Amazon subspecies (cf. Ibis, 1919, pp. 25–29). Peters assigned this form a questionable status in vol. 2 of his Check-List, and suggested that the validity of the characters alleged required confirmation. We can report our entire inability to confirm them, or in fact to find any constant differences of any kind, and suggest that Hellmayr in his study of the Spix types was entirely correct in regarding *rufinus* (Spix) as a straight synonym of *gujanensis*.

Family OPISTHOCOMIDAE

118. Opisthocomus hoazin (P.L.S. Muller)

Type locality: Cayenne

Pará (Wallace, Snethlage, Stone); Rio Inhangapy (Stone); Rio Capim (Goeldi); Ilha das Oncas, San Antonio do Prata, Marajo Island (Snethlage, Pinto); Santarem (Chapman and Riker)

2 ♂, Pará, Val-de-Caes
1 ♂, Santarem (Carnegie Mus.)

Family ARAMIDAE

119. Aramus scolopaceus scolopaceus (Gmelin)

Type locality: Cayenne

Pará (Hellmayr, Snethlage, and Stone); Mexiana Island (Hagmann); Marajo Island (Snethlage)

1 ♂ 1 ♀, Rio Tapajoz, Santarem
1 ♀, Rio Tapajoz, Pinhy
1 ♂, Rio Amazonas, Lago Jauary, Livramento
1 ♀, Rio Amazonas, Lago Grande
1 ♂, Rio Amazonas, Lago Cuipeuz
1 ♂, Santarem (Carnegie Mus.)

Family PSOPHIIDAE

120. Psophia crepitans crepitans (Linnaeus)

Type locality: Cayenne
1 ?, Lago Cuipeua, Obidos (Pinto)

A considerable southward extension of range, but to have been expected.

121. Psophia viridis obscura Pelzeln

Type locality: Pará
Pará (Natterer and Wallace); Rio Capim (Goeldi); Rio Acará (Hellmayr and Snethlage); Utinga (Conover)

122. Psophia viridis interjecta Griscom and Greenway, 1937

Type locality: Cametá, left bank, Rio Tocantins
1 ♂, the type.

Combining the characters of *obscura* and *viridis*, but geographically intermediate between *obscura* and *dextralis*. All four subspecies are strikingly distinct. It will be of interest to see what *Psophia* turns up on the Rio Xingú.

123. Psophia viridis dextralis Conover

Type locality: Tauary, right bank of Rio Tapajoz
Rio Tapajos, Tauary and Caxiricatuba (Conover)
2 ♂ 3 ♀, Rio Tapajoz, Tauary and Pinhy
1 ♂, do. , Miriti-tuba (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)

Conover records a *Psophia* from the Rio Camaraipi as *dextralis*, but it is obviously a connecting link between *dextralis* and *obscura*. This river is between the Xingú and the Tocantins. If it is not the form here described, it will probably prove to represent still another.

124. Psophia viridis viridis (Spix)

Type locality: Villa Nuova, Amazons (erroneously)
Left bank of the Rio Tapajoz at Boim (Conover)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

This form ranges west to the right bank of the Rio Madeira.

Family RALLIDAE

125. Rallus longirostris subsp.

Marajo Island (Snethlage)

The Clapper Rail from the mouth of the Amazon still awaits subspecific determination. Typical *longirostris* is known from the Guianas; *crassirostris* Lawrence from southern and central Brazil north to Maranhao.

126. Pardirallus maculatus maculatus (Boddaert)

Type locality: Cayenne

3 ♀ in the zoological garden at Pará, probably from the environs of the capital (Snethlage); an old skin from the "Amazon River" (British Museum); Pará (Stone)

127. Aramides cajanea cajanea (P.L.S. Muller)

Type locality: Cayenne

Rio Capim (Goeldi); Mexiana Island (Hagmann and Snethlage); Pará (Graham in Brit. Mus., Snethlage and Stone); Marajo Island (Snethlage); Santarem (Chapman and Riker)

1 ♀, Rio Capim
1 ♂, Rio Acará, Acará
4 ♀, 1 ?, Rio Tapajoz, Pinhy and Tauary
2 ♂ 3 ♀, Santarem (Carnegie Mus.)
1 ♀, Obidos (do.)
1 ♀, do., Goyana Isl. (do.)

We cannot see the slightest reason for recognizing *grahami* Chubb from Lower Amazonia.

128. Amaurolimnas concolor castaneus (Pucheran)

Type locality: Brazil

Utinga and Santarem (Pinto)

1 ♂, Rio Tapajoz, Boim
1 ♂, Santarem (Carnegie Mus.)

This rare rail has hitherto been unknown between the Guianas and southern Brazil. The male recorded above was so strikingly different from the two currently recognized races that a third subspecies was obviously involved. They are characterized as follows:

1. typical *concolor* (Gosse), 1847. Known only from Jamaica, and apparently extinct. Of relatively large size, of paler coloration, the olives and brown tones predominating over the rufescent. Specimens examined, the type in Brit. Mus., 1 ad. Lawrence Coll. in New York, 2 ad. in Lafresnaye Coll., Mus. Comp. Zool., one badly faded.

2. *guatimalensis* (Lawrence). Very rare and local from Guatemala through Central America to west Ecuador. Much smaller than typical *concolor*, and strikingly darker, more olive less rufescent above, more sooty brown below. Seven specimens including the type examined. One from the Rio Solimoes (Carnegie Mus.) is transitional to the next.

3. *castaneus* (Pucheran). Definitely known only from Amazonian Brazil southward to Bahia, Sao Paulo and Matto Grosso. As large as *concolor*, but strongly rufous and chestnut, instead of olive and brown with a rufescent tinge; strikingly distinct from *concolor*, and appearing a different species when compared with *guatimalensis*. Only two specimens examined.

A word about the nomenclature is in order. *Rallus castaneus* Cuvier is an MS name, based on a definite specimen from Brazil and labelled *castaneus* in Cuvier's handwriting. The name *castaneus* Cuvier has, of course, no nomenclatural status. It was taken up by Lesson, but not properly validated by him, as there is no description. It was, however, validated by Pucheran, (Rev. et Mag. Zool., 1851, p. 279) who gave a detailed description and critique of the "type", which is clearly subspecifically identifiable today. While, therefore, *castaneus* Pucheran (1851) is a synonym of the specific name *concolor* Gosse (1847), it is available for the Brazilian subspecies. *Rufirallus boecki* Bonaparte (1856) "Bolivia" given by Gray (1871), is clearly a synonym of *castaneus* (Pucheran), but *castaneus* Bonaparte (1856) cannot be definitely allocated, until Guiana specimens are identified subspecifically.

concolor—Wing: type 127, 2ad. 124, 1 ad. (♀ ?) 119; tarsus. 43–46; culmen 25–30.

guatimalensis—Wing: ♂ 118, ♀ 110–113; tarsus, ♂ 41, ♀ 35–39; culmen, 25–27.

castaneus—1 ♂, wing 125, tarsus 46, culmen 26.

128. Porzana flaviventer flaviventer (Boddaert)

Type locality: Cayenne

Rio Guamá, Ourem (Snethlage, 3 ♂ in Goeldi Museum)

129. Porzana albicollis albicollis (Vieillot)

Type locality: Paraguay

1 ♂, north bank of Amazon near Obidos, Lago Cuipeuz

One of the many rare Rails, the distribution of which is poorly known. This species is fairly well known in southern and eastern Brazil only. The very distinct *typhoeca* Peters from Santa Marta leaves much of eastern South America as a debatable ground. Our specimen, while not typical *albicollis*, is assuredly nearer it than to *typhoeca*.

130. Laterallus exilis exilis (Temminck)

Type locality: Cayenne

Pará (Snethlage, Stone); Peixe-Boi (Hellmayr); Utinga (Pinto)

1 ♂ 3 ♀, Rio Tapajoz, Tauary

131. Laterallus melanophaius lateralis (Lichtenstein)

Type locality: Bahia, Brazil

Pará (Stone); Rio Guamá (Layard and Snethlage); Igarape-Assu (Hellmayr)

132. Laterallus viridis viridis (P.L.S. Muller)

Type locality: Cayenne

Pará (Natterer, Wallace, Snethlage and Stone); San Antonio and Igarape-Assu (Hellmayr); Benevides, Rio Guamá, Cussary (Snethlage); Rio Tapajoz, Boim (Snethlage); Santarem (Chapman and Riker)

1 ♂, Pará, Bosque

4 ♂, 1?, Rio Tapajoz, Tauary

2 ♀, Obidos (Carnegie Mus.)

1 ♂ 2 ♀, Benevides (do.)

2 ♂ 2 ♀, Santarem (do.)

Birds from the south bank of the Amazon are inseparable from a great Cayenne series in the Carnegie Museum.

133. Neocrex erythrops erythrops (Sclater)

Type locality: Lima, Peru

Rio Jamundá, Faro (Snethlage and Pinto)

This rare rail is best known from far upper Amazonia. It is doubtful if any of these birds east of the Andes are typical *erythrops*. They may prove to be *olivascens* Chubb, or a fourth subspecies.

134. Gallinula chloropus galeata (Lichtenstein)

Type locality: Paraguay
Pará (Snethlage and Pinto)

135. Porphyrula martinica (Linnaeus)

Type locality: Martinique
Pará (Snethlage); Rio Tocantins (Pinto)
1 ♀, Rio Capim, Ipanongo
2 ♂, Rio Acará, Buenos Aires
1 ♂ 1 ♀, Rio Tapajoz, Tauary
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

136. Porphyrula parva (Boddaert)

Type locality: Cayenne
Pará, Monte Alegre, Cussary (Snethlage); Pará (Stone)
1 ♂, Rio Amazonas near Obidos, Lago Cuipeuz
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

Family HELIORNITHIDAE

137. Heliornis fulica (Boddaert)

Type locality: Cayenne
Rio Capim (Goeldi); Pará (also Stone), Cussary, Maracá, Monte Alegre (Snethlage); Santarem (Chapman and Riker); Rio Tapajoz and Obidos (Pinto)
6 ♂ 3 ♀, Rio Tapajoz, Pinhy
1 ♂, Rio Tapajoz, Santarem

Family EURYPYGIDAE

138. Eurypyga helias helias (Pallas)

Type locality: Surinam
Cajutuba (Natterer); Rio Capim (Goeldi); Acará (Hellmayr); Mexiana Island (Hagmann); Rio Guamá, Marajo and Mexiana Islands, Monte Alegre (Snethlage)
2 ♂ 1 ♀, Rio Tapajoz, Caxiricatuba
1 ♂, Rio Tapajoz, Santarem
1 ♀, Rio Tapajoz, Pinhy
1 ♂ 3 ♀, Pará, Val-de-Caes

Family JACANIDAE

139. Jacana spinosa jacana (Linnaeus)

Type locality: Surinam

Pará (Layard, Stone); Rio Capim (Goeldi); Mexiana Island (Hagmann); Salvaterra, Marajo Island, Cussary (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)

1 ♂ 4 ♀, Rio Tapajoz, Pinhy
3 ♂, 1 ?, Rio Tapajoz, Caxiricatuba
1 ♀, Obidos (Carnegie Mus.)
1 ♀, Santarem (do.)
2 ♂ ad., 1 ♂ juv. 1 ♀, Rio Tapajoz, Apacy (do.)

Family HAEMATOPODIDAE

140. Haematopus ostralegus palliatus (Temminck)

Type locality: Venezuela

Pará (Snethlage); Cajutuba (Natterer)

The Oystercatcher ranges south to southeastern Brazil (Cape Trio, Goeldi; Santa Catharina, Rogers).

Family CHARADRIIDAE

141. Belonopterus chilensis cayennensis (Gmelin)

Type locality: Cayenne

Pará (Layard); Mexiana Island (Hagmann, Wallace, Snethlage); Marajo Island (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)

1 ♂, Rio Tapajoz, Santarem
1 ♂, Rio Amazonas, Lago Grande
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

It is, of course, possible that some of the records below might prove referable to *lampronotus* (Wagler). (cf. Hellmayr, 1909, p. 491).

142. Hoploxypterus cayanus (Latham)

Type locality: Cayenne

Rio Capim (Goeldi); Mexiana Island (Hagmann); Rio Guamá, Rio Tocantins, Rio Tapajoz (Snethlage); Santarem (Hellmayr)

1 ♀, Rio Tapajoz, Pinhel
7 ♂, Rio Tapajoz, left bank (Carnegie Mus.)

143. Pluvialis dominica dominica (P.L.S. Müller)

Type locality: Hispaniola
Marajo Island (Snethlage)
1 ♂, Rio Tapajoz, Pinhel, May 21, 1933

It is certainly interesting to find this bird in partial breeding plumage in eastern Brazil in late May.

144. Squatarola squatarola (Linnaeus)

Type locality: Sweden
Cajutuba (Natterer)

145. Charadrius semipalmatus Bonaparte

Type locality: New Jersey
Pará (Stone); Cajutuba (Natterer); Mexiana Island (Wallace); Marajo Island (Snethlage)

146. Charadrius collaris Vieillot

Type locality: Paraguay
Cajutuba (Natterer); Mexiana Island (Wallace, Hagmann and Snethlage); Marajo Island (Snethlage); Quati-Puru; Rio Tapajoz, Goyana and Boim; Rio Jamundá, Faro (all Snethlage); Santarem (Chapman and Riker)
4 ♂ 1 ♀, Rio Tapajoz, Pinhel and Boim
2 ♂ 1 ♀, Santarem (Carnegie Mus.)

147. Charadrius wilsonia wilsonia Ord

Type locality: Cape May, New Jersey
Catjutuba and Rio Muria (Natterer)

The occurrence of Wilson's Plover in Brazil seems to have been overlooked in recent years by everyone except Hellmayr. It has been taken as far south as Bahia (Dr. Wucherer in Brit. Mus.). For the reasons for regarding these birds as North American migrants, cf. Hellmayr, 1929, p. 492.

Family SCOLOPACIDAE

148. Bartramia longicauda (Bechstein)

Type locality: North America
1 ♂, Rio Tocantins, Baião (Snethlage)
1 ♀, Santarem, Sept. 15, 1920 (Carnegie Mus.)

149. Numenius phaeopus hudsonicus (Latham)

Type locality: Hudson Bay
Cajutuba (Natterer); Pará (R. Graham); Marajo Island (Snethlage)

150. Tringa flavipes (Gmelin)

Type locality: New York
Cajutuba (Natterer); Mexiana Island (Wallace and Hagmann); Marajo Island (Snethlage)
4 ♀ 1 ?, Rio Tapajoz, Santarem, Oct. 4–8, 1932
2 ♂ 1 ♀, Santarem, Sept. 16, 1919 (Carnegie Mus.)

151. Tringa melanoleuca (Gmelin)

Type locality: Labrador
Cajutuba (Natterer); Marajo Island (Snethlage); Pará (Graham and Stone)

152. Tringa solitaria solitaria Wilson

Type locality: Pennsylvania
Pará (Graham, Layard, Stone); Peixe-Boi (Hellmayr); Mexiana Island (Wallace); Capanema, Bragança, Rio Guamá, Marajo Island, Rio Tapajoz (Snethlage)
1 ♀, Rio Tapajoz, Tauary, Dec. 1, 1933
1 ♀, Rio Tapajoz, Pinhel, May 18, 1933
1 ♀, Amazon River near Obidos, March 2, 1933
4 ♂ 1 ♀, Santarem, March 26, April 12–17, Aug. 2, 1919 (Carnegie Museum)
1 ♀, Obidos, May 2, 1921 (Carnegie Mus.)
1 ♂, Rio Tapajoz, Feb. 24, 1921

153. Actitis macularia (Linnaeus)

Type locality: Pennsylvania
Cajutuba (Natterer); Mexiana Island (Wallace); Pará (Graham and Stone); Marajo Island, Cunany (Snethlage); Santarem (Chapman and Riker)
1 ♂, Rio Tapajoz, Pinhy, May 20, 1933
1 ♀, Santarem, Oct. 14, 1919 (Carnegie Mus.)

154. Catoptrophorus semipalmatus semipalmatus (Gmelin)

Type locality: New York
"Single birds, rare, 2 specimens, March, 1835", Cajutuba (Natterer)

This Brazilian record for the Willet has been completely overlooked by recent American authors, and also by Snethlage.

155. Arenaria interpres morinella (Linnaeus)

Type locality: Georgia
Pará and Cajutuba (Natterer, February, March, and April, 1835)

156. Limnodromus griseus griseus (Gmelin)

Type locality: New York
Cajutuba, April, 1835, 5 specimens, Cajutuba (Natterer); Marajo Island (Snethlage)

157. Capella paraguaiae paraguaiae (Vieillot)

Type locality: Paraguay
Pará (Stone, Graham); Bragança, Marajo Island, Monte Alegre (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)
1 ♂, Obidos (Carnegie Mus.)
1 ♀, Santarem (do.)

158. Crocethia alba (Pallas)

Type locality: North Sea
Cajutuba, November, 1835 (Natterer)

159. Ereunetes pusillus (Linnaeus)

Type locality: Santo Domingo
Cajutuba, March and April, 1835 (Natterer); Mexiana Island (Wallace); Marajo Island (Snethlage)
1 ♂, Rio Tapajoz, Santarem; Nov. 18, 1932

160. Erolia minuta (Vieillot)

Type locality: Nova Scotia
Pará (Layard); Mexiana Island (Wallace, Hagmann); Marajo Island (Snethlage)

161. Erolia fuscicollis (Vieillot)

Type locality: Paraguay
Rio Tocantins (Wallace); Bragança (Snethlage)
1 ♂ 5 ♀, Rio Tapajoz, Pinhel, May 16–19, 1933

162. Erolia melanotos (Vieillot)

Type locality: Paraguay
1 ♂ 2 ♀, Rio Tapajoz, Santarem, Oct. 4, 1932
1 ♂, Rio Amazonas, Lago Grande, Sept. 6, 1932

These are the only records for Lower Amazonia. The species is well known, however, just west and south of our area in Upper Amazonia and Matto Grosso.

Family RECURVIROSTRIDAE

163. Himantopus himantopus mexicanus (P.L.S. Müller)

Type locality: Mexico
Cajutuba (Natterer); Mexiana Island (Wallace, Hagmann, Snethlage); Marajo Island (Snethlage); Monte Alegre (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)

Natterer's specimen was reported by Pelzeln as *melanurus* Vieillot. There is no satisfactory evidence as yet that any Stilt breeds in northern Brazil, or that *melanurus* ranges anywhere nearly so far north as the Amazon Valley.

Burhinus bistriatus vocifer (L'Herminier) is recorded by Snethlage from "Pará (zoological garden)". It is a bird of the savannah regions, Colombia, Venezuela and Guiana, and the nearest definite record to our area is the upper Rio Branco in northwestern Brazil. As a definite locality, Pará in this sense cannot be taken literally.

Family LARIDAE

164. Larus atricilla Linnaeus

Type locality: Bahamas
Cajutuba, Feb. 20, 1835 (Natterer); Marajo Island (Snethlage)

165. Phaëtusa simplex simplex (Gmelin)

Type locality: Cayenne
Pará (Layard, Stone); Cajutuba (Natterer); Mexiana Island (Wallace); Quatipuru, Marajo Island, Monte Alegre (Snethlage); Santarem (Chapman and Riker)
1 ♂, 1 ♀, Rio Tapajoz, Tauary and Caxiricatuba
2 ♀, Santarem (Carnegie Mus.)

166. Gelochelidon nilotica grönvoldi Mathews

Type locality: South America
Marajo Island (Snethlage)

The reported breeding of this species on Mexiana Island goes back to Hagmann. Hellmayr, however, has shown that his identification was erroneous (cf. Hellmayr, 1910, p. 122, footnote 6).

167. Sterna hirundo Linnaeus

Type locality: Sweden
Pará, March 3, 1936; Marajo Island, Jan. 3, 1936 (cf. Lincoln, Bird-Banding, Oct., 1936, pp. 146 and 147)

168. Sterna superciliaris Vieillot

Type locality: Paraguay
Cajutuba (Natterer); Peixe-Boi (Snethlage); Rio Tocantins (Wallace); Pará and Rio Tapajoz (Pinto)
3 ♂ 7 ♀, Rio Tapajoz, Santarem and Pinhel
1 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)

169. Sterna fuscata fuscata Linnaeus

Type locality: Santo Domingo
Mouth of the Amazon (Saunders Coll., in Brit. Mus.)

170. Sterna albifrons antillarum (Lesson)

Type locality: Guadeloupe
Marajo Island (Snethlage)

171. Thalasseus maximus maximus (Boddaert)

Type locality: Cayenne
Pará, 1 ♂ (Snethlage)

172. Thalasseus sandvicensis acuflavidus (Cabot)

Type locality: Yucatan
Cajutuba (Natterer); Mexiana Island, breeding (Hagmann)

173. Anoüs stolidus stolidus (Linnaeus)

Type locality: West Indies
"At sea off north Brazil, Oct. (Brit. Mus.)

Family RYNCHOPIDAE

174. Rynchops nigra cinerascens Spix

Type locality: Amazon River
Pará (Stone); Cajutuba (Natterer); Mexiana Island (Wallace); Marajo Island (Snethlage)
1 ?, Rio Tapajoz, Villa Braga (Carnegie Mus.)

Family COLUMBIDAE

175. Columba speciosa Gmelin

Type locality: Cayenne
Pará (Natterer and Wallace); Rio Muraiteua (Stone); Ipitinga and San Antonio (Hellmayr); Rio Capim (Goeldi); Monte Alegre, Cussary, Rio Tapajoz, Rio Jamundá (Snethlage); Santarem (Chapman and Riker, Pinto); Marajo Island (Brodkorb)
1 ♂, Rio Tapajoz, Tauary
1 ♀, Santarem (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

176. Columba rufina rufina Temminck

Type locality: Cayenne
Rio Jamundá, Faro (Snethlage); Caviana Island (Brodkorb)
1 ♂, 1 ♀, Rio Amazonas, Lago Cuipeuz

177. Columba rufina sylvestris Vieillot

Type locality: Paraguay
Pará (Stone); Mexiana Island (Wallace & Snethlage) Benevides, Marajo Island, Rio Tocantins, Rio Tapajoz (Snethlage); Santarem (Chapman and Riker)
13 ♂ 8 ♀, Rio Tapajoz; various localities, east bank
2 ♂ 1 ♀, Rio Tapajoz, west bank. (Carnegie Mus.)

We entirely agree with Hellmayr that the Amazon River is the boundary between typical *rufina* of the Guianas, and *sylvestris* of northern Argentina northward (cf. Birds of Northeast Brazil, p. 464). No birds from the Amazonian basin are really typical of either, but are variously intermediate. The long series from the Rio Tapajoz has an obviously bicolored tail, but the majority not as sharply contrasted as Argentina and Sao Paulo specimens. Similarly, the two birds from the north bank of the Amazon are much nearer true *rufina*.

178. Columba plumbea wallacei Chubb

Type locality: Rio Capim, Pará, Brazil

Rio Capim (Wallace, Goeldi); Pará (Stone); San Antonio and Ipitinga (Hellmayr); Rio Jamauchim, Santa Elena (Snethlage); Santarem (Chapman and Riker).

1 ♀ imm., Obidos (Carnegie Mus.)
2 ♂, 2 ♀, Rio Tapajoz. Villa Braga (do.)

Todd, 1937, has straightened out the great local confusion in these pigeons. Having examined the same material, we fully endorse his main conclusions. The series from the Rio Purus, representing *pallescens* Snethlage, proves the lower Amazon birds to be another subspecies, as Hellmayr long ago suggested. There is, however, the remote possibility that *locutrix* Wied, based on Bahia birds, might prove to belong to the present form. In far upper Amazonia, Zimmer (Birds Peruvian Exped., 1930, p. 256) has resurrected the name *delicata* Berlepsch and Stolzmann for the birds from northern Bolivia to Peru, Ecuador and Colombia, of which *propinqua* Cory and *andicola* Chubb are synonyms. Based on meager material this name would appear to contain two elements, a larger, darker bird from Bolivia, and a smaller, paler one northward, which has yet to be compared with authentic *pallescens*.

179. Columba subvinacea recondita Todd, 1937

Type locality: Colonia do Mujuy, Santarem, Brazil

Rio Gurupy, Rio Tocantins (Snethlage)

1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

This bird is the *Columba purpureotincta* of Snethlage and Pinto, *nec* Ridgway, a little known subspecies of British Guiana and adjacent

Venezuela, which closely resembles *bogotensis* in color, but differs only in its dwarf dimensions. Wing measurements are appended.
bogotensis—4 ♂ 163–173; 5 ♀ 165–175
recondita—Rio Purus, 3♂ 164–170; 3♀ 153–156
recondita—Obidos, 1 ♂ 151 ; 1♀ 154 (both immature)
recondita—Santarem, 1 ♂ 160
recondita—Rio Tapajoz, 1 ♂ 163; 1 ♀ 155 (immature)
recondita—Rio Tocantins 2 ♂ 155; (*fide* Snethlage)
purpureotincta 4 ? 146.5–149.5 (*fide* Ridgway)

In both species, *plumbea* and *subvinacea*, immature specimens are smaller than adults. They are recognizable in having some buffy edgings to the feathers of the mantle and nape, and rusty edgings to the under tailcoverts.

180. Zenaida auriculata marajoensis Berlepsch

Type locality: Marajo Island
San Juão, Pará (Layard); Mexiana Island (Wallace, Hagmann and Snethlage); Marajo Island (Berlepsch and Snethlage)

181. Zenaida auriculata jessiæ Ridgway

Type locality: Diamantina, Rio Tapajoz
Diamantina (Ridgway); Santarem (Chapman and Riker); Ereré (Snethlage); Paricatuba (Schulz in Frankfort Museum); Rio Tapajoz (Pinto).
2 ♂ 2 ♀, Santarem (Carnegie Mus.)

For the latest opinion on the races of this species see Naumburg, Amer. Mus. Novit., no. 648, 1933.

182. Columbigallina passerina griseola (Spix)

Type locality: Amazon River
Pará (Layard, Natterer Stone); Bemfica (Steere); Rio Capim (Goeldi); San Antonio (Hellmayr); Santarem (Chapman and Riker); Pará, Quatipuru, Maracá, Monte Alegre, Rio Xingú, Victoria (Snethlage)
8 ♂, 16 ♀ Rio Tapajoz, various localities
4 ♂, Rio Amazonas, Lago Cuipeuz
2 ♀, Rio Amazonas, Boca do Igarapé Piaba
3 ♂ 1 ♀ Obidos (Carnegie Mus.)
3 ♂ 1 ♀ Benevides (do.)
1 ♂ Santarem (do.)
4 ♂ 1 ♀ Rio Tapajoz, both banks (do.)

183. Columbigallina talpacoti talpacoti (Temminck)

Type locality: Brazil
Pará (Natterer); Castanhal (Stone); Nazaré (Layard); Peixe-Boi (Hellmayr); Mexiana Island (Hagmann); Pará (Snethlage); Arumanduba, Ererć, Rio Maecuru (Snethlage); Rio Tocantins, Alcobaça (Snethlage); Rio Tapajoz, Goyana (Snethlage) and Santarem (Chapman and Riker); Marajo Island (Brodkorb)

13 ♂, 8 ♀ Rio Tapajoz, various localities
2 ♂, 3 ♀, Rio Acará, Acará
1 ♂ Obidos (Carnegie Mus.)
1 ♂ Santarem (do.)
8 ♂ 6 ♀, Rio Tapajoz, both banks (do.)

With the greatly increased material in this museum both from Surinam and southern Brazil since Bangs and Penard described *C. arthuri*, we agree absolutely with Hellmayr (Birds Northeast Brazil, p. 468) that matters of individual variation are involved. The present fine series shows this quite graphically. Several birds resemble one from Sao Paulo in having more rufous on the primaries than the type of *arthuri;* perhaps half have some rufous, and the remainder are solid black. It is consequently quite impossible to divide this series into two artificial "species". Twenty-one specimens from the Guianas divide in a similar fashion, so that it seems impossible to recognize *arthuri* even as an intermediate race connecting the Central American *rufipennis*, a mere geographical representative, with *talpacoti*.

184. Uropelia campestris (Spix)

Type locality: Bahia
Marajo Island (Snethlage)

One of the many characteristic campo birds of central and southern Brazil, which ranges north to this island, but is absent from the forested sections of Lower Amazonia.

185. Claravis pretiosa (Ferrari-Perez)

Type locality: Brazil
Rio Maecuru (Snethlage)
1 ♂, Santarem (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

186. Leptoptila verreauxi approximans Cory

Type locality: Serra de Baturité, Ceará, Brazil
Monte Alegre and Rio Jamundá (Faro); Mexiana and Marajo Islands (all Snethlage); Rio Tapajoz and Santarem (Pinto)
3 ♂ 3 ♀, Rio Tapajoz, various localities
5 ♂ 2 ♀, Rio Amazonas, Lago Cuipeuz
1 ♂, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)

The characters of this race have been fully discussed by Hellmayr (Birds Northeast Brazil, p. 471), who also shows that the Guiana race must be known as *brasiliensis* Bonaparte. Our series from the north bank of the Amazon is inseparable from the Tapajoz series, showing that *brasiliensis* (=*tenella* Penard, type before us) does *not* extend so far south as the Amazon, in this section at least.

187. Leptoptila rufaxilla rufaxilla (Richard and Bernard)

Type locality: Cayenne
Obidos and Rio Jamundá, Faro (Snethlage); Mexiana Island (Wallace, Hagmann, Snethlage); Caviana Island (Brodkorb); Pará (Stone); Rio Muria (Natterer); Rio Tapajoz, Mararu, Goyana (Snethlage); Santarem (Chapman and Riker)
2 ♀ Obidos (Carnegie Mus.)
1 ? Santarem (M.C.Z.), 1 ♂ do. (Carnegie Mus.)
3 ♂ ad., 1 ♂ imm., 2 ♀ ad, 1 ♀ imm., Rio Tapajoz, right bank (M.C.Z.)
2 ♂ 2 ♀, Rio Tapajoz, both banks (Carnegie Mus.)

The fine series from Cayenne in the Carnegie Museum proves that lower Amazonian birds are inseparable, and that Dutch and British Guiana specimens, long assumed to represent true *rufaxilla*, are in reality a different subspecies, *hypochroos* Griscom and Greenway.

188. Oreopeleia violacea violacea (Temminck and Knip)

Type locality: South America
San Antonio (Hellmayr)

189. Oreopeleia montana (Linnaeus)

Type locality: Jamaica

Pará (Wallace Stone); Rio Capim (Goeldi); Mocajatuba, Ananindeua, Santa Isabel, Benevides, Peixe-Boi (Snethlage); Rio Tocantins (Cametá), Rio Curuá, and Rio Tapajoz, Boim (Snethlage); Obidos (Snethlage); Obidos and Santarem (Pinto)

2 ♂ 2 ♀, Rio Tapajoz, Tauary
1 ♂, Obidos (Carnegis Mus.)
1 ♂, Santarem (do.)

Family PSITTACIDAE

190. Anodorhynchus hyacinthinus hyacinthinus (Latham)

Type locality: none given by Latham; "Brazil" of later authors; we designate Rio Tapajoz, Tauary

Rio Capim (Goeldi); Monte Alegre (Snethlage); Santarem (Chapman and Riker); Rio Tapajoz (Bates in Brit. Mus.)

1 ♂ 1 ♀, Rio Tapajoz, Tauary

The lovely Hyacinthine Macaw has largely been overlooked in recent decades in the lower Amazon valley and has become associated in people's minds with central and southwestern Brazil. The receipt of specimens from the lower Amazon shows that the Matto Grosso bird is quite distinct. Latham's original description was based on a bird in a private museum with no locality. The chances, however, are that a specimen would have reached Europe prior to 1790 from Pará rather than the interior of southern Brazil, and we consequently restrict the type locality on this basis. *Psittacus augustus* Shaw, 1792, no definite locality, is based on a live bird belonging to Lord Orford. By the same reasoning, we restrict this name to "vicinity of Pará, in lower Amazonia." The name of the Matto Grosso race will consequently be *Anodorhynchus hyacinthinus maximiliani* Spix, type collected Oct. 20, 1827, at Rio das Flechas, Matto Grosso. This subspecies is the one generally represented in most collections. The typical form is obviously a brighter blue both above and below, more ultramarine, less purplish, most conspicuous on the underparts; lower mandible 5–8 mm. longer, and width of bill at gape 5 mm. + narrower, the whole bill consequently relatively longer and slenderer. We are indebted to the American Museum in New York for the opportunity of comparing our Tapajoz skins with their fine series from Matto Grosso (5 ♂ 4 ♀).

191. Ara ararauna (Linnaeus)

Type locality: Brazil
Mexiana Island (Wallace); Santarem (Allen)
1 ♂, Santarem (Carnegie Mus.)

192. Ara macao (Linnaeus)

Type locality: Pernambuco
Pará (Natterer); Rio Capim (Goeldi); Mexiana Island (Wallace and Hagmann); Rio Guamá, Ourem; Rio Tocantins, Aramatheua; Rio Jamundá, Faro (the last three, Snethlage); Rio Tocantins (Pinto)

193. Ara chloroptera Gray

Type locality: Guiana
Pará (Natterer); Rio Capim (Goeldi); Santarem (Chapman and Riker); Rio Maracá, Rio Tocantins (Aramatheua), Rio Jamauchim (Snethlage).
1 ♂ 1 ♀, Rio Tapajoz, Tauary and Caxiricatuba

194. Ara severa (Linnaeus)

Type locality: Amazon River
Mexiana Island (Hagmann, Snethlage); Santarem (Pinto)
3 ♂, Rio Tapajoz, Santarem
1 ♂, Santarem (Carnegie Mus.)

195. Ara maracana (Vieillot)

Type locality: Paraguay
Cajutuba (Natterer); Marajo Island (Snethlage); Santarem (Chapman and Riker)

196. Ara manilata (Boddaert)

Type locality: Cayenne
Monte Alegre, Cussary, Marajo Island (Snethlage); Pataua (Pinto)
1 ♂, Benevides (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)

197. Ara nobilis cumanensis (Lichtenstein)

Type locality: Brazil-Cuman, Maranhao
Pará (Wallace); Cajutuba (Natterer)

This small Macaw seems to have a range, which is practically identical with that of *Anodorhynchus*. Further north, it is replaced by typical *nobilis*, formerly better known as *hahni* Souancé, which is not known nearer our region than the Rio Branco.

198. Aratinga guarouba (Gmelin)

Type locality; northeastern Brazil

Pará (Natterer, Wallace Stone); Peixe-Boi (Hellmayr and Snethlage); San Antonio do Prato, Rio Tocantins, Rio Xingú (Snethlage); Rio Tocantins (Pinto)

Outside of our area this conure is known only from the adjacent state of Maranhao.

199. Aratinga solstitialis (Linnaeus)

Type locality: Cayenne

Monte Alegre and Ereré (Snethlage); Santarem (Pinto)

This species replaces the last from the north bank of the Amazon north to the Guianas.

200. Aratinga leucophthalmus leucophthalmus (P.L.S. Müller)

Type locality: Guiana

Pará and Cajutuba (Natterer); Mexiana Island (Hagmann); Marajo Island, Rio Tocantins, Rio Jamundá (Snethlage); Santarem (Chapman, Riker and Pinto)

4 ♂ 4 ♀, Rio Tapajoz, Santarem

1 ♂ 1 ♀, Obidos (Carnegie Mus.)

2 ♂, Santarem (do.)

A common and widely distributed parrakeet, represented by the race *callogenys* Salvadori in extreme upper Amazonia.

201. Aratinga aurea aurea (Gmelin)

Type locality: Brazil

Pará (Graham); Mexiana Island (Wallace and Hagmann); Caviana Island (Brodkorb); Marajo Island (Hellmayr and Snethlage); Monte Alegre, Ereré, Igarape de Paituna, Rio Jamundá (Snethlage); Santarem (Chapman, Riker and Pinto)

5 ♂ 2 ♀, 1 ?, Rio Tapajoz, Santarem

8 ♂ 3 ♀, Santarem (Carnegie Mus.)

Another common parrakeet in eastern South America, passing in the extreme south into *major* Cherrie and Reichenberger. Unlike *leucophthalmus*, however, it is unrecorded west of the Rio Madeira basin.

202. Pyrrhura picta amazonum Hellmayr

Type locality: Obidos

Rio Tocantins, Cussary, Monte Alegre, Rio Tapajos (Snethlage); Obidos (Hellmayr and Snethlage); Santarem (Chapman and Riker, Hellmayr); Obidos and Santarem (Pinto)

3 ♂, 1 ♀, Rio Tapajoz, Caxiricatuba
1 ♂, Rio Tapajoz, Caxiricatuba
10 ♂, 6 ♀, Obidos (Carnegie Mus.)
7 ♂, 6 ♀, Santarem (do.)

This variable species is represented by true *picta* in the Guianas and Venezuela and by *lucianii* Deville in far upper Amazonia. According to Snethlage, birds from the Rio Madeira are another undescribed race, but Hellmayr doubts this.

[*Pyrrhura melanura* (Spix) is a well known species of upper Amazonia, which is not definitely known east of the Rio Solimoes and the Rio Negro. There is a specimen in the old British Museum collection by Bates from "Tocantins", Amazon River. This "Tocantins" (really Tonantins) must not be confused with the Rio Tocantins in our area.]

203. Pyrrhura perlata lepida (Wagler)

Type locality: Amazon River

Pará (Natterer); San Antonio (Hellmayr); Rio Capim (Wallace); Peixe-Boi (Hellmayr); Benevides (Snethlage); Igarape-Assu (Hellmayr); Utinga (Pinto)

204. Pyrrhura perlata anerythra (Neumann)

Type locality: Rio Tocantins, Arumatheua

from type station, 2 ♂ (Neumann); Cametá, 1 ♂ (Sieber in Berlin Museum)

Only known from the specimens listed above. Prof. Neumann's revision (Verh. Orn. Ges. Bayern, **17**, no. 4, 1927) shows that typical *perlata* (Spix) is only known from the two cage-bird types, which may be a mere cage variety, as suggested by Hellmayr.

205. Pyrrhura rhodogaster Sclater

Type locality: Borba, Rio Madeira
1 ♂, Rio Jamauchim (Snethlage); 1 ♀, Rio Arapiuns (Pinto)
1 ♂, Rio Tapajoz, Boim
2 ♂ 1 ♀, Rio Tapajoz, Apaçy (Carnegie Mus.)

This rare parrot is only known from the localities mentioned above.

206. Forpus modestus modestus Cabanis

Type locality: British Guiana
1 ♀ imm., Rio Tapajoz, Aveiros (Carnegie Mus.)

This bird agrees with a series from the Rio Purus of this very dark species with the blackish upper mandible. We have, however, no typical material.

207. Forpus passerinus subsp.

Pará, Rio Jamauchim, Recreio and Porto Seguro (Snethlage)

There is still some uncertainty about *Forpus* in Lower Amazonia. Snethlage is the only person who has seen a series from Pará. These birds she distinguishes from *deliciosus* Ridgway (Santarem), in that adult males have bright ultramarine blue rumps and a lot of yellow on the forehead and sides of the head. She calls these birds *modestus* Cabanis, but it would appear certain that she did not understand that species. Her description leads one to infer that her birds will turn out to be *flavissimus* Hellmayr (Maranhao). Stone records a single female from Pará as *modestus* also.

208. Forpus passerinus deliciosus (Ridgway)

Type locality: Diamantina Creek, near Santarem
Santarem (Chapman and Riker, Snethlage); Monte Alegre, Igarapé de Paituna, Rio Jamundá (Snethlage); Obidos (Hellmayr and Pinto)
5 ♂ 3 ♀, north bank of Amazon near Obidos and south bank, Lago Grande
1 ♀, Rio Tapajoz, Tauary
2 ♂, Obidos (Carnegie Mus.)
12 ♂ 13 ♀, Santarem (do.)

209. Brotogeris versicolurus versicolurus (P.L.S. Müller)

Type locality: Cayenne

Pará (Natterer Stone); Benevides (Steere); Rio Inhangapy, Rio Guamá (Stone); Mexiana Island (Wallace, Hagmann, Hellmayr); Marajo Island (Hellmayr, Snethlage); Ilha das Oncas, Serra de Paituna, Rio Jamundá, Rio Tocantins (Snethlage); Santarem (Chapman and Riker, Hellmayr)

3 ♀, Pará, Val-de-Caes
1 ♀, Rio Tapajoz, Pinhel
2 ♀, Lago Grande
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
8 ♂ 5 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz (do.)

210. Brotogeris chrysopterus tuipara (Gmelin)

Type locality: northeastern Brazil

Pará (Layard, Natterer, Wallace Stone); Ourem (Stone); Igarape-Assu (Hellmayr); Rio Capim (Goeldi); Peixe-Boi and Ipitinga (Hellmayr); Ilha das Oncas, Rio Barcarena, Marapanim, San Antonio do Prata, Providencia, Rio Tocantins (all Snethlage); Santarem (Chapman and Riker); Marajo Island (Brodkorb)

5 ♂ 5 ♀, Pará, Val-de-Caes and Bosque
7 ♂ 4 ♀, Rio Tapajoz, Tauary and Caxiricatuba
7 ♂ 2 ♀, Santarem (Carnegie Mus.)
1 ♂ 1 ♀, Benevides (do.)

211. Brotogeris chrysopterus chrysopterus (Linnaeus)

Type locality: Guiana

Rio Jary, San Antonio da Cachoeira, and Monte Alegre (Snethlage); Obidos (Pinto)

3 ♂ 1 ♀, Obidos (Carnegie Mus.)

These two subspecies represent each other on the south and north banks of the Amazon. They are replaced by *chrysonema* on the Rio Madeira.

212. Brotogerys st. thomae takatsukasae (Neumann)

Type locality: north bank of the Amazon opposite Santarem

Monte Alegre (Snethlage, Neumann); Maracá (Snethlage)

6 ♂ 4 ♀, north bank of Amazon near Obidos
1 ♀, Rio Tapajoz, Santarem
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
13 ♂ 12 ♀, Santarem (do.)

Typical *st. thomae* ranges east to the Rio Madeira. We confirm Neumann's color characters. Specimens seen by us from eastern Ecuador in this museum and New York are radically larger than our lower Amazonian series.

213. Amazona farinosa farinosa (Boddaert)

Type locality: Cayenne

Pará (Natterer); Castanhal (Stone); Peixe-Boi (Hellmayr and Snethlage); Rio Capim (Goeldi); Mexiana Island (Hagmann); Rio Jamauchim (Snethlage); Obidos and Pará (Pinto)

8 ♂ 2 ♀, Rio Tapajoz, Tauary
2 ♀, north bank of Amazon near Obidos
1 ♂, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)
1 ♂, Rio Tapajoz (do.)

214. Amazona amazonica amazonica (Linnaeus)

Type locality: Surinam in error—"les pays des Amazones"

Cajutuba (Natterer); Rio Capim (Goeldi); Mexiana Island (Hagmann); Ilha das Oncas, Marajo Island, Amapá, Rio Jamauchim (Snethlage)

1 ♂, Pará, Val-de-Caes
1 ♀, imm., Rio Tapajoz, Villa Braga (Carnegie Mus.)

A very widely ranging species represented by *micra* Griscom and Greenway on the Surinam coast, which may prove to have a wider distribution.

[*Amazona aestiva aestiva* (Linnaeus) is listed in Snethlage's Aves do Amazonicas on the basis of specimens in the zoological garden at Pará. It is not known north of Pernambuco, and Pará cannot be regarded as a definite locality for this species.]

215. Amazona ochrocephala subsp.

Santarem (Chapman and Riker); Caxiricatuba, Rio Tapajoz (Pinto)

1 ♀, Obidos (Carnegie Mus.)
1 ♀, Santarem (do.)

216. Amazona ochrocephala xantholaema Berlepsch

Type locality: Marajo Island

Marajo Island (Berlepsch and Snethlage)

The status of this species in Lower Amazonia still remains to be determined. Snethlage was about to describe this race, as a new

species, apparently referring all Brazilian records and those from "neighboring countries to the north" to it. The species was collected by Natterer on the Rio Branco; apparently the Santarem record given above is the only basis for the occurrence of the species between northwestern Amazonia and Marajo Island. The relationship of alleged *ochrocephala* from the *south* bank of the Amazon to *nattereri* from the Rio Madeira should also be investigated.

217. Amazona festiva festiva (Linnæus)

Type locality: Guiana

Pará (Graham in Brit. Mus.); Mexiana Island (Hagmann and Snethlage); Monte Alegre (Snethlage); Santarem (Chapman and Riker); Lago Pataua and Lago Cuipeua (Pinto)

3 ♂ 5 ♀, north bank of Amazon near Obidos
1 ?, Rio Tapajoz, Santarem.
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)

One of these birds is *chloronota* Souancé in having a green rump and red at the bases of the outer tail feathers; another has the red in the tail, but a crimson rump; two others have a few red feathers in an otherwise green rump. It will be apparent, therefore, that we have here either an age or a mutational variation so common in these parrots; not only is *chloronota* not a distinct species, but it seems to us to have no status as a subspecies either (see Cory, Cat Birds Amer., pt. 1, 1918, p. 88).

218. Graydidasculus brachyurus insulsus

(Griscom & Greenway, 1937)

Type locality: Lago Grande, south bank of Amazon

Pará (Hellmayr); Amapa, Monte Alegre, Rio Jamunda (Snethlage); Santarem (Chapman & Riker); Pataua (Pinto)

1 ♂, Rio Tapajoz, Santarem
1 ♂, 2 ♀ 1 ?, north bank of Amazon near Obidos
4 ♂, 2 ♀ south bank, Rio Amazonas, Lago Grande
1 ♂ 4 ♀, Obidos (Carnegie Mus.)
11 ♂ 6 ♀, Santarem (do.)

Typical *brachyurus* is a much larger bird of Upper Amazonia, with a proportionately smaller and weaker bill.

219. Pionus menstruus menstruus (Linnæus)

Type locality: Surinam

Cajutuba (Natterer); Igarape-Assu (Robert); Ilha das Oncas, Benevides, Santa Antonio do Prata, Peixe-Boi, Rio Acara, Rio Tocantins (Snethlage); Santarem (Chapman and Riker); Maraca, Obidos, Rio Jamunda, Campos de Ariramba (Snethlage)

5 ♂, 3 ♀, 1 ?, Rio Tapajoz, Pinhy, Tauary, Boim
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)
1 ♂ 1 ♀, Obidos (do.)
1 ♂ 3 ♀, Santarem (do.)

220. Pionus fuscus (P.L.S. Müller)

Type locality: Cayenne

Pará (Natterer and Wallace); Rio Capim (Goeldi); Igarape-Assu and Ipitinga (Hellmayr); Mocajatuba, Providencia, Benevides, Peixe-Boi, Rio Acara, Rio Tocantins (Snethlage); Santarem (Chapman and Riker)

2 ♂ 2 ♀, Rio Tapajoz, Tauary
1 ♀, north bank of Amazon near Obidos
2 ♂, Obidos (do.)
1 ♂ 2 ♀, Santarem (do.)
2 ♂ 3 ♀, Rio Tapajoz, various localities (Carnegie Mus.)

221. Deroptyus accipitrinus accipitrinus (Linnæus)

Type locality: Cayenne by subsequent designation Maraca and Obidos (Snethlage)

1 ♂, north bank of Amazon near Obidos
1 ♂ 3 ♀, Obidos (Carnegie Mus.)

222. Deroptyus accipitrinus fuscifrons Hellmayr

Type locality: Rio Acara, Igarape-Assu

Pará (Natterer, Stone); Benevides (Steere); Igarape-Assu and Peixe-Boi (Hellmayr); Rio Capim (Goeldi); Rio Jamauchim (Snethlage)

1 ♂, Rio Acara, Acara
1 ♀, Rio Tapajoz, Tauary
1 ♀, Benevides (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Miriti tuba (do.)

These two very distinct races are supposed to replace each other on the two sides of the main Amazon. According to Hellmayr, the present subspecies ranges westward for an undetermined distance. In Brazil there are apparently no definite records west of the Rio Tapajoz, but a

specimen in the British Museum from Sarayacu, east Ecuador is *fuscifrons*. Hellmayr regarded this locality as "very doubtful", and Chapman does not record the genus from Ecuador. Pinto claims that two specimens from Santarem are obviously the northern race!

223. Pionopsitta caica (Latham)

Type locality: Cayenne
2 ♂, 1 ♀, Rio Jamunda, Faro (Snethlage); Rio Atabany (Pinto)
1 ♀, Obidos (Carnegie Mus.)

These are the only records for this common Guiana species in our area. Another member of the genus, *barrabandi* (Kuhl), just reaches extreme northwestern Brazil, and one of the tributaries of the Rio Madeira.

224. Gypopsitta vulturina (Kuhl)

Type locality: Brazil
Pará (Wallace, Stone); Castanhal, Rio Gurupy (Stone); Igarape-Assu and Peixe-Boi (Hellmayr); Rio Capim (Goeldi); Providencia, St. Antonio do Prata, Rio Moju, Rio Tocantins, Rio Tapajoz (Snethlage)
1 ♂, Rio Acara, Acará
1 ♂, Benevides (Carnegie Mus.)
6 ♂ 4 ♀, Santarem (do.
1 ♀, Rio Tapajoz, Villa Braga (do.)

This genus is practically endemic in our area, but on the south bank of the Amazon only. Westward it ranges to the right bank of the Rio Madeira. In coloration it so exactly resembles *Pionopsitta barrabandi* as to raise the presumption that the two birds are representative forms, with perfectly complementary ranges. We know of no better illustration in tropical American parrots to endorse the suspicion that undue weight has been given to striking color differences, and that there are far too many "species" and "genera."

225. Touit purpurata purpurata (Gmelin)

Type locality: Cayenne
Pará (Natterer and Snethlage); Rio Capim (Wallace); Ipitinga (Hellmayr)
1 ♂, Benevides (Carnegie Mus.)

Touit hueti (Temminck). Type locality: Peru. Pará (Snethlage).

This is a species of far upper Amazonia, and there is no other definite record for Brazil. The genus is exceedingly difficult to collect and is easily overlooked, but Snethlage's locality "Pará" would certainly seem to need confirmation. Pinto (1937) probably correctly omits this species from the Brazil list.

226. Pionites melanocephala melanocephala (Linnæus)

Type locality: Cayenne
Maraca and Obidos, north side of the Amazon (Snethlage, Pinto)
3 ♂ 4 ♀, Obidos (Carnegie Mus.)

227. Pionites leucogaster leucogaster (Kuhl)

Type locality: Brazil
Pará (Natterer); Rio Muraiteua, Utinga (Stone); Igarape-Assu, San Antonio do Prata, Peize-Boi (Hellmayr); Providencia and Rio Acara (Snethlage)
1 ♀, Pará, Bosque
1 ♂, Santarem (Carnegie Mus.)

This species is replaced by *xanthurus* Todd on the Rio Purus, and by *xanthomerius* (Sclater) in extreme upper Amazonia east to the Rio Solimoes. Hellmayr's record (1910) of *leucogaster xanthomerius* from the Rio Madeira probably belongs to *xanthurus* Todd. All are subspecies, and it is more than likely that all three should be regarded as representative forms of *melanocephala*. We have examined the series in the Carnegie Museum, and note that no mention of *xanthurus* is made in Peter's Check-List, (vol. 3) or in Pinto's Catalogue.

Family CUCULIDAE

228. Coccyzus minor minor (Gmelin)

Type locality: Cayenne
Cajutuba (Natterer)

The most southern record for this species. It should be sought along the coast, and a Brazilian series should be compared with Guiana topotypes.

229. Coccyzus melacoryphus Vieillot

Type locality: Paraguay

Pará, Rio Tocantins, Rio Xingú, Monte Alegre, Ereré, Rio Maecuru, Rio Jamundá (Faro.)

4 ♂ 2 ♀, Rio Tapajoz, Santarem.

4 ♂ 4 ♀, Santarem (Carnegie Mus.)

230. Coccyzus euleri (Cabanis)

Type locality: Cantagallo, southeast Brazil

Santarem (Chapman and Riker); Pará (Snethlage)

1 ♂, Rio Tapajoz, Santarem

1 ♀, Santarem (Carnegie Mus.)

There is still considerable uncertainty regarding the status and proper name of this species. There is no doubt that *C. euleri* Cabanis is definitely a rare cuckoo of Argentina and southern Brazil, ranging north to the south bank of the Amazon, perhaps as a winter visitor only. What we do not know is its relationship to C. *americanus*, of which it may be only a representative form. Ridgway inclined to this view, and believed that the type of *C. julieni* Lawrence, from Sombrero Key, Lesser Antilles, was an earlier name for *euleri*, and that the breeding bird of the West Indies was probably the same thing. There are two difficulties involved. In the first place breeding adults from Santo Domingo are not separable from typical *americanus*. In the second place the type of *julieni* was a fall migrant only on Sombrero, a barren rock with a lighthouse. It follows that *julieni* can only be a migrating individual of *americanus*, and the senior author, who is familiar with Lawrence's type, regards it as an immature *americanus* of minimum size, and certainly not *euleri* of southern Brazil. We consequently endorse Hellmayr's recent contention (1929, p. 432), not to call *euleri, americanus julieni*. We have examined the type of *lindeni* Allen from Santarem, which is certainly a synonym of *euleri*. Some Cuckoo, either *americanus* or *euleri*, is recorded from the Guianas and Trinidad, though there are no specimens on record in America. They will almost surely prove to be *euleri* as a winter visitant, or the West Indian breeding stock of *americanus*, which is as yet unknown definitely east of Venezuela. Snethlage's record of *C. americanus* from Pará presumably belongs here.

231. Piaya cayana cayana (Linnæus)

Type locality: Cayenne

1 ♀, Pará, Bosque
2 ♀, Rio Acará, Acará
7 ♂ 4 ♀, Rio Tapajoz, various localities east bank
1 ♀, Obidos (Carnegie Mus.)
2 ♂, Benevides (do.)
3 ♂ 2 ♀, Santarem (do.)
2 ♂ 3 ♀, Rio Tapajoz (do.)

The identity of the squirrel cuckoos of Lower Amazonia has been left in abeyance for some years, due to the inability of any student to compare a topotypical series of *obscura* Snethlage from the Rio Purus with adequate material from any other part of Amazonia. Thus various museums, lacking a Rio Purus series, have referred specimens from the Rio Madeira to *obscura* on geographic grounds, and on the other hand have acted similarly with birds from northeastern Peru. The latest comment on Lower Amazon birds is that of Hellmayr (1929, p. 434), who showed that Pará birds were a different subspecies from any in Brazil just south of the Amazon valley, and intermediate between *pallescens* Cabanis and Heine and *obscura* Snethlage to which he assigned all birds from the Rio Madeira to eastern Peru. These birds have just been named *hellmayri* by Pinto (1938).

We have before us a nice series of topotypes of *obscura* from the Rio Purus. It turns out that *obscura* of recent authors, *nec* Snethlage, is a composite of two races. Rio Madeira birds in the American Museum are *obscura*, but specimens in New York and Chicago from eastern and northeastern Peru are not *obscura*, immediately separable in being much darker below, and constitute a connecting link between *obscura* and *boliviana* Stone. Whether these birds have sufficient geographic range and clear cut characters to merit the description of still another subspecies must be left to Mr. Zimmer, who alone has adequate material at his command. But our impression of very inadequate material is that it is as distinct a race as many another now currently recognized.

We may now return to the identity of Lower Amazonian birds. With the darker Peruvian element extracted from our concept of *obscura*, we see no necessity for describing a lower Amazonian race. Birds from Pará and the Rio Tapajoz are clearly distinct from *pallescens*, but they are not clearly distinct from *obscura*. Perhaps one in four specimens approaches *pallescens* either in paler upper parts, paler throat, or paler gray ventral surface, but it will be apparent that lower Amazonian birds have no color character of their own, and are very much

nearer *obscura* on the average than anything else. There is a slight tendency for tail length to increase as the westward limits of the range are approached, but the difference between the extremes of the two series is less than half the difference between extreme individuals in either series.

Rio Purus ♂ 280–294; ♀ 243–278

Rio Tapajoz ♂ 271–290, the majority below 280 mm.; ♀ 245–265

Pará region ♀ 256–270

The character used by Madame Snethlage to distinguish her 3 specimens of *obscura* from Pará specimens of what she called *P. cayana* (Linnæus) was the much darker color of the under tail-coverts. This is apparently a matter of individual variation. One Rio Purus bird is indeed quite the darkest of all Amazonian specimens seen. Five others, slightly paler, are identical with ten more eastern specimens. One is still paler and agrees with four more eastern specimens. It is interesting to note that the darkness of coloration of the thighs and under tailcoverts does not vary proportionately with the relative darkness or paleness of the abdomen. We have no hesitation, therefore, in referring all birds from the south side of the Amazon from the Rio Purus eastward to *obscura* Snethlage.

It now remains to determine the relations between *obscura* and true *cayana* from Cayenne. A very fine series in the Carnegie Museum from French Guiana is at hand, which gives an adequate idea of the considerable individual variation that occurs. It seems to us impossible to separate *obscura*. Half the series differ from the majority of true *cayana* in having minutely darker under tailcoverts. There are no other color differences whatever, and there proves to be no difference in tail length. This seems to us to be far too slight a character for nomenclatural recognition. The birds of Lower Amazonia can all be referred to typical *cayana*, it being understood that eastward an increasing percentage of specimens approach *pallescens* in one or another characteristic.

We give no locality records, as this abundant bird has been obtained in every part of our area by all collectors, with the single exception of Marajo Island.

232. Piaya melanogaster melanogaster (Vieillot)

Type locality: Cayenne, by subsequent designation

2 ♂ 1 ♀, Obidos (Carnegie Mus.)

3 ♀, Rio Tapajoz, Villa Broga (do.)

Not previously recorded east of the Rio Madeira. The Obidos birds agree perfectly with a fine series from Cayenne. Those from the Tapajoz and a fine series from the Rio Purus and Rio Solimoes do not appear to differ constantly in color characters, but the bills are much darker, apparently more red, less orange or yellow in life.

233. Coccycua minuta minuta (Vieillot)

Type locality: Cayenne

Pará (Layard, Wallace, Stone); Utinga (Hellmayr); Mexiana Island (Hagmann and Hellmayr); Marajo Island, Cussary, Rio Jary, Monte Alegre, Rio Jamundá (Snethlage); Santarem (Chapman and Riker, Hellmayr); Rio Cunany (Pinto)

1 ♀, Rio Amazonas, north bank near Obidos
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
3 ♀, Santarem (do.)
1 ♂ 2 ♀, Rio Tapajoz, various localities (do.)

Birds from the Lower Amazon are not separable from a fine series from Cayenne in the Carnegie Museum.

234. Tapera naevia naevia (Linnæus)

Type locality: Cayenne

Pará (Layard Stone); Igarape-Assu (Hellmayr); Castanhal (Stone); Mexiana Island (Hagmann, Hellmayr, Wallace); Marajo Island, Quati-Puru, St. Antonio do Prata, Maracá, Monte Alegre (Snethlage)

1 ♂ 1 ♀, Rio Tapajoz, Santarem
3 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Benevides (do.)
1 ♂, Santarem (do.)
1 ♂, Rio Tapajoz, Itaituba (do.)

235. Neomorphus geoffroyi geoffroyi (Temminck)

Type locality: Brazil

Pará (Natterer and Snethlage); Igarape-Assu and St. Antonio do Prata (Hellmayr); Rio Capim (Goeldi); Cussary (Snethlage)

According to Temminck's account in the Planches Col., his description was based on birds in two private collections and on specimens in the museums of Paris, Berlin, Vienna and Leyden (given in the order mentioned). As one of the private collections was that of Prince Neuwied, Temminck obviously had Bahia as well as Amazonian

specimens. As the Bahia bird has been described as *dulcis* Snethlage, 1927, the question arises which of the two subspecies involved should actually be typical *geoffroyi*. In 1905, (p. 298) Hellmayr designated Bahia ex Wied as are stricted type locality, but in 1929, (p. 436), after the description of *dulcis* by Snethlage, suggested that the application of Temminck's name should await "the examination of the type in Leyden." There being no holotype, and Leyden being the last of the numerous listed collections to be mentioned, we can see no reason for applying the name on the basis of a specimen in the Leyden Museum. As a matter of fact we have before us an Amazon specimen of *geoffroyi* and an example of *dulcis* Snethlage from the interior of Bahia. They are very different subspecies, and Temminck's detailed description and excellent colored plate apply very definitely to the bird from around Pará, which has long been known as *geoffroyi*. We suggest Pará, therefore, as a restricted type locality and as a probable source of many of the older skins in the great collections. We might add that all detailed descriptions of *geoffroyi* in the literature, based on Pará birds, agree with Temminck's original description and plate in all the respects, which we now know to be of subspecific importance.

236. Neomorphus squamiger squamiger Todd

Type locality: Colonia do Mojuy, Santarem, Brazil
Previously known only from the four specimens in the type series in the Carnegie Museum, examined by us
1 ♂ 1 ? (both adult), Rio Tapajoz, Tauary (right bank)

The rarity of the Cuckoos of this genus is readily seen by the fact that Klages, the discoverer of *squamiger*, "sought for it in vain along the Tapajoz." Further comments on this form will be found under the next.

237. Neomorphus squamiger iungens subsp. nov.

Type.—No. 173564, Mus. Comp. Zool.; ♀ ad.; Boim, left bank of the Rio Tapajoz, Pará, Brazil; Jan. 10, 1933; A.M. Olalla

Characters. Differing from *squamiger* in having the feathers of forehead and pileum buffy brown tipped with dull bluish and with bluish centers; mantle slightly more bronzy green; secondaries greener, less coppery red; auricular region much deeper cinnamon buff; chin and throat uniform rich buff, instead of soiled whitish or grayish; dark subterminal area of breast feathers less extensive; narrow pectoral

collar much more distinct. Differing from *lepidophanes* in the buffy forehead and pileum; secondaries bronzy green, not coppery red; chin and throat buffier, less white; breast squamated, and much narrower pectoral collar.

In Todd's original description of his two supposed species (Proc. Biol. Soc. Wash., **38**, 1925, p. 112), *lepidophanes* was compared with *pucherani* Deville, but *squamiger* was not compared with any member of the genus. His only comment was that *squamiger* was unique in the restriction of the bare area on the side of the head. Our birds, however, show that this is an age or individual variation, as they have just as big a bare orbital space as *geoffroyi* and bigger than several specimens of *salvini*.

Many years ago (1910) Hellmayr predicted that *geoffroyi*, *pucherani* and *salvini* would probably turn out to be representative forms. The discoveries of recent years amply support his contention. These rare terrestrial cuckoos are an old group of undoubted Old World origin, which have probably occupied their present ranges for a very long time. We now have definite evidence that, like the Trumpeters, the larger rivers are barriers they will not cross, and we find very different birds on opposite banks of these rivers. Our prediction is, therefore, that still other races of these cuckoos remain to be discovered, and that they will turn out still more closely to connect birds currently regarded as specifically distinct.

At the present state of our definite knowledge, it must be admitted that at first sight *geoffroyi* and *squamiger* appear very different. However, it should be noted that some at least of the *geoffroyi* characters reappear in other races further west. In particular, *iungens* is in general coloration a complete "throw back" to *geoffroyi*, and *salvini aequatorialis* Chapman is nearer in general coloration to *geoffroyi* than any of the intermediate "species". We present the following synopsis.

I. Whole side of head and neck barred.
   a. Forehead and pileum cinnamon; breast light cinnamon buff; chest browner; subterminal bars on feathers of breast dusky, narrower. Typical *geoffroyi*. Pará region to the Rio Acará. (ranging further westward?)
   b. Forehead and pileum paler, buffy; breast paler, buffy; chest grayer; subterminal bars of breast feathers much broader. *dulcis* Snethlage. Eastern and southeastern Brazil.

II. Side of head and neck uniform, never barred.
   a. Throat and breast strongly squamated, caused by black subterminal bars.

1. Forehead and pileum mostly bluish like crest; secondaries coppery green, rather than olive green as in *geoffroyi;* chin and throat and chest soiled whitish; subterminal bars on breast very broad, sometimes the entire feather black with a grayish tip; scarcely any pectoral collar. *squamiger* Todd. Right bank of the Rio Tapajoz, for an unknown distance eastward.
2. Forehead cinnamon buff as in *geoffroyi;* secondaries olive green as in *geoffroyi;* chin, throat and chest rich buffy; subterminal bars on breast feathers narrower; a definite but very narrow pectoral collar; (in these respects intermediate between *geoffroyi* and *squamiger*). *iungens* Griscom and Greenway. Left bank of the Rio Tapajoz to the right bank of the Rio Madeira.
3. Forehead bluish as in *squamiger;* secondaries coppery red; chin and throat whitish as in *squamiger;* breast and chest clay color much as in *geoffroyi;* underparts rich buff as in *iungens;* squamation on breast much as in *iungens;* pectoral collar broad. *lepidophanes* Todd. Rio Purus to right bank of Rio Solimoës, perhaps east to left bank of Rio Maderia.

b. Breast faintly squamated, the feathers with pale tips, but subterminal bar, if present, only faintly darker than rest of feather.
1. Forehead rich cinnamon rufous as in *geoffroyi;* secondaries coppery, intermediate between *squamiger* and *lepidophanes;* underparts intermediate between *lepidophanes* and *pucherani*, the color of the belly and undertailcoverts much less rich and dark than any preceding race, and less contrasted with chest; pectoral collar broad and complete as in (*lepidophanes* and *pucherani*). *aequatorialis* Chapman. Known only from a few localities in Amazonian Ecuador.
2. Forehead much paler, less rufescent; pectoral collar narrower and incomplete. *salvini*. Southern Central America and parts of Colombia.

c. No squamation of any kind; feathers of breast and chest entirely uniform.
1. Forehead bluish or purplish, as in *squamiger* and *lepidophanes;* secondaries rich coppery red as in *lepidophanes;* chin to chest uniform clay color, the extreme in this

direction of tendencies in *acquatorialis* and *lepidophanes;* entire balance of underparts also clay color, the vent and under tailcoverts only faintly darker; broad complete pectoral collar. *pucherani* Deville. Rio Ucayali in northeastern Peru east to the left bank of the Rio Solimoës (fide Todd), but series from these two extremes should be compared.

In conclusion we wish to point out that no *Neomorphus* is known from the Rio Acara to the Rio Tapajoz, and the genus is as yet unrecorded in the enormous area on the north side of the main Amazon from west of the Rio Negro to Amazonian Ecuador. We also suggest that the differences between *radiolosus* and *rufipennis* and any member of the group here discussed are the criteria for valid specific differences in this genus.

238. Dromococcyx pavoninus Pelzeln

Type locality: Araguaya, Brazil

1 ♀ imm., Obidos (Carnegie Mus.)

While not previously recorded from Lower Amazonia, the occurrence of this little known species was to have been expected.

239. Crotophaga major Gmelin

Type locality: Cayenne

Ipitinga (Hellmayr); Rio Capim (Wallace and Goeldi); Rio Inhangapy (Stone); Mexiana Island (Hagmann); Pará, Ilha das Oncas, Benevides, Marajo Island (Snethlage); Santarem (Chapman and Riker); Caviana Isl. (Pinto)

3 ♂ 1 ♀, north bank of Amazon near Obidos
2 ♂, Rio Tapajoz, Santarem and Caxiricatuba
1 ♂, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz (do.)

240. Crotophaga ani Linnæus

Type locality: Brazil

Pará (Layard); Igarape-Assu (Hellmayr); Rio Capim (Goeldi); Rio Inhangapy (Stone); Mexiana Island (Wallace and Hagmann); San Antonio do Prata, Marajo Island (Snethlage); Santarem (Chapman and Riker)

2 ♂ 1 ♀, south bank of Amazon, Lago Grande
1 ♂ 1 ♀, Rio Tapajoz, Santarem and Pinhy
1 ♀, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)

241. Guira guira (Gmelin)

Type locality: Brazil

Mexiana Island (Wallace and Hagmann); Marajo Island, Capanema, Quati-Puru (Snethlage); Caviana Island (Brodkorb)

One of the many characteristic birds of southern Brazil, which ranges north along the coast to the mouth of the Amazon.

Family TYTONIDAE

242. Tyto alba hellmayri Griscom & Greenway, 1937

Type locality: Paramaribo, Surinam

Pará (Hellmayr, Snethlage, Pinto); Marajo Island (Snethlage); Mexiana Island (Hagmann); Santarem (Hellmayr)

1 ♂ 1 ♀, Rio Tapajoz, Santarem

A much larger bird than the southern *tuidara*, the distinctness of which Hellmayr suspected years ago.

Family STRIGIDAE

243. Asio stygius stygius (Wagler)

Type locality: Brazil

1 ♂ 2 ♀, Rio Tapajoz, Pinkhy and Tauary

These birds constitute the first definite record for the Lower Amazon. [*Rhinoptynx clamator* can confidently be expected in our area, and should be sought for carefully]

244. Bubo virginianus subsp.

Vicinity of Pará (Snethlage)

This bird, if not representing an undescribed race, might be *deserti* Reiser. The horned owl should be sought on Mexiana and Marajo Islands.

245. Pulsatrix perspicillata perspicillata (Latham)

Type locality:

Pará (Natterer); Marajo Island, Monte Alegre, Rio Tocantins, Rio Tapajoz (Snethlage); Santarem (Chapman and Riker)

246. Otus choliba crucigerus (Spix)

Type locality: Amazon River

Mexiana Island (Wallace, Hagmann); Pará (Stone); Pará, Marajo Island, Rio Tocantins (Snethlage); Obidos (Hellmayr)

2 ♂ 1 ♀, 1 ?, Rio Tapajoz, Pinhy
1 ♀, north side of Amazon near Obidos
1 ♂, Obidos (Carnegie Mus.)
1 ♂, juv., Santarem (do.)
1 ♀, Rio Tapajoz (do.)

This is the widely distributed race of the Guiana—Amazon region. In the campo country further south it is replaced by *decussatus* (Lichtenstein).

247. Otus watsonii usta (Sclater)

Type locality: Ega, upper Amazon

Rio Tapajoz, Pinhel (Snethlage); Utinga (Pinto)

1 ♂ 1 ♀, Rio Tapajoz, Tauary and Caxiricatuba

In default of adequate material, these birds are subspecifically identified only provisionally, but Chapman (Birds Ecuador, 1926, p. 246) has restricted the type locality of *watsonii* Cassin to the "Napo, Region, east Ecuador", while *ustus* Sclater was from "Ega on the upper Amazon". Compare also Naumburg, Birds of Matto Grosso, 1930, p. 117, who inadvertently uses the combination "*usta watsoni*".

248. Lophostrix cristata cristata (Daudin)

Type locality: Guiana

Pará (Wallace); Santarem (Chapman and Riker); Monte Christo and Obidos (Pinto)

2 ♂, Rio Tapajoz, Tauary and Caxiricatuba
1 ♂, Santarem (Carnegie Museum)

249. Ciccaba virgata superciliaris (Pelzeln)

Type locality: Brazil

Pará (Wallace); Ipitinga (Hellmayr); Rio Curuá (Snethlage); Murutucu (Pinto)

1 ♂, Rio Tapajoz, Tauary

This specimen agrees with the Pará bird described by Sharpe in the Catalogue of Birds in having a black and white barred tail. Pinto

records the Murutucu specimen as true *virgata*, which is quite impossible. Presumably his bird represents the dark phase of *superciliaris*.

250. Ciccaba huhula (Daudin)

Type locality: Cayenne
1 ♀, Obidos (Snethlage)

It is very doubtful if *huhula* and *nigrolineatum* are really specifically distinct.

251. Glaucidium brasilianum brasilianum (Gmelin)

Type locality: Brazil
Pará (Snethlage)

According to Hellmayr typical *brasilianum* ranges north to the south bank of the Amazon. The species will surely be found on the north bank, where there is open country. Such birds might prove to be *phalænoides*.

Family NYCTIBIIDAE

252. Nyctibius griseus cornutus (Vieillot)

Type locality: Paraguay
Pará (Natterer and Snethlage); Rio Capim (Layard); Rio Jamauchim (Snethlage); Murutucu (Pinto)
2 ♂, Rio Tapajoz, Tauary and Caxiricatuba
1 ♀, Santarem (Carnegie Mus.)

Amazonian birds are really intermediate between the large *cornutus* and the very small *griseus* of the Guianas. Our birds are distinctly nearer the former, however, and have more pronounced barring on the inner webs of the primaries. It is possible that specimens from the north bank of the Amazon might prove referable to *griseus*.

253. Nyctibius longicaudatus (Spix)

Type locality: Rio Japura, Brazil
1 ♂, Rio Capim, Resacca (Snethlage)

254. Nyctibius æthereus (Wied)

Type locality: Bahia
Mexiana Island (Hagmann, fide Hellmayr)

In default of specimens we can only cite the records for these two species, which are still very rare in collections. Our belief, however, is that they are two representative subspecies, and that the two records from our area really deal with an intermediate population which is a connecting link between the two.

255. Nyctibius grandis (Gmelin)

Type locality: Cayenne

Pará, Rio Moju, Marajo Island (Hellmayr and Snethlage); Obidos (Hellmayr); Santarem and Pataua (Pinto)

2 ♂, 5 ♀, north bank of Amazon near Obidos

1 ♂, 1 ?, Rio Tapajoz, Santarem

2 ♀, Santarem (Carnegie Mus.)

Family CAPRIMULGIDAE

256. Chordeiles acutipennis acutipennis (Hermann)

Type locality: Cayenne

Cajutuba (Natterer); Pará, Marajo Island, Monte Alegre, Rio Jamundá, Rio Tocantins, Rio Xingú (Snethlage)

9 ♂ 1 ♀, Santarem (Carnegie Mus.)

3 ♂ 1 ♀, Rio Tapajoz, Apacy (do.)

As with many widely ranging South American birds, this Nighthawk is larger in the south. Guiana birds are the smallest, and those from the extreme southern limits of the range are appreciably larger. It follows that intermediate birds occupy the greater part of the range in eastern South America, and we see no point in recognizing a southern race, for which *brasilianus* (Gmelin) is the earliest of several available names, which probably apply to this species.

257. Chordeiles rupestris rupestris (Spix)

Type locality: Rio Negro

Rio Tapajoz (Snethlage)

1 ♂ 1 ♀, Rio Tapajoz, Pinhel and Caxiricatuba

10 ♂ 11 ♀, Rio Tapajoz, various localities (Carnegie Mus.)

The subspecific variations of this species remain to be determined, and those proposed require confirmation with a good series of topotypes from the Rio Negro, as well as series from the type localities

of *zaleucus* Oberholser (Pebas, Peru) and *xyostictus* Oberholser ("Bogota", Colombia, where the species does not occur!). As a whole it is an upper Amazonian species, and on the south side of the Amazon has been found eastward only on the Rio Madeira and the Rio Tapajoz. The record of "Pará" in Ihering's Cat. Fauna Bras., 1907, p. 132, certainly requires confirmation.

If there really is any racial variation in this species, one would expect that the birds from the south side of the Amazon would differ from those of the Rio Negro. Hellmayr (1910) claimed that the differences between Peruvian and Rio Madeira specimens were "insignificant". It is possible, therefore, that our birds from the Rio Tapajoz may prove to be *zaleucus*.

258. Nyctiprogne leucopyga (Spix)

Type locality: Amazon River
Monte Alegre and Rio Jamundá, Faro (Snethlage)
1 ♂ 2 ♀, 1 ?, Rio Tapajoz, Pinhy
1 ♀, Santarem (Carnegie Mus.)
3 ♂ 6 ♀, Rio Tapajoz, various localities (do.)

A characteristic river forest Nighthawk, which reaches the southern limit of its range on the south side of the Amazon. In the more open campo country it is replaced by *Nannochordeiles pusillus*, which is unknown in the Amazonian forest area.

259. Podager nacunda nacunda (Vieillot)

Type locality: Paraguay
Pará (Hellmayr, Stone); Rio Capim (Wallace); Quati-puru and Rio Tocantins (Snethlage)
3 ♂ 6 ♀, Rio Tapajoz, various localities.
6 ♂ 15 ♀, Santarem (Carnegie Mus.)

The wings of our females measure 234–246 mm., thus running slightly smaller than birds from southern Brazil. It is possible that specimens from the northwestern corner of our area (Rio Jamundá to Obidos) might prove referable to *minor* Cory of the Rio Branco, Brazil, northward.

260. Lurocalis semitorquatus nattereri (Temminck)

Type locality: Brazil
Pará (Wallace); Strada Bragança (Layard); Ilha das Oncas (Snethlage)

A very little known bird in our area, apparently more common southward. Typical *semitorquatus* of the Guianas is even less known, and its southern limits remain to be determined. A specimen collected by Natterer on the Rio Icanná is currently referred to this race. This river is a small tributary on the west side of the Rio Negro in extreme northwestern Amazonas, near both the Colombian and Venezuelan boundaries.

261. Hydropsalis crasiliana crasiliana (Gmelin)

Type locality: northeastern Brazil
Rio Xingú and Santarem (Snethlage); Santarem (Pinto).
1 ♂ 1 ♀, Rio Tapajoz, Santarem
2 ♀, Santarem (Carnegie Mus.)

Another little known species, which ranges west to the Rio Madeira and south to Bahia and Matto Grosso. Still further south it is replaced by the larger and paler *furcifera* (Vieillot).

262. Hydropsalis climacocerca canescens

Griscom & Greenway, 1937.

Type locality: Lago Grande, south bank of Amazon, west of Rio Tapajoz
2 ♂ 2 ♀, Lago Grande; 1 ♂, Rio Tapajoz, Pinhel
1 ♂, Rio Tapajoz, Itaituba (Carnegie Mus.)

As yet only known from the localities listed above, and possibly Manacapuru, Rio Solimoes.

263. Hydropsalis climacocerca pallidior Todd, 1937.

Type locality: Santarem
14 ♂ 5 ♀, Santarem (Carnegie Mus.)

264. Hydropsalis climacocerca intercedens, Todd, 1937.

Type locality: Islands in Amazon, near Obidos
1 ♂ 3 ♀, Obidos (Carnegie Mus.)

This distinct subspecies is, in our opinion, an obvious connecting link between *climacocerca* and the dark *schomburgki* of British Guiana.

In spite of the two recent papers on this species, the writers do not agree wholly in their interpretation of the same material, and other

points still await proper series and study. Mr. Todd agrees with us that a fourth very distinct, buffy subspecies occurs on the Rio Purus. He refers Rio Solimoes birds to *canescens*, while we suspect that they are subspecifically distinct. The question still remaining to be settled is what are the exact subspecific characters of true *climacocerca* from the lower Ucayali River, Peru? We assumed that the Rio Solimoes birds might represent it. Mr. Todd thinks that the Rio Purus birds probably do. On the other hand, we were not prepared to separate birds from the two banks of the Rio Tapajoz as different subspecies. It follows, therefore, that good series from the Rio Ucayali and the Rio Solimoes may alter the present picture in one of several possible ways.

Incidentally the British Museum Catalogue records a specimen by Wallace from the "Rio Tocantins". There is every possibility that Tonantins in Upper Amazonia is actually intended. In no case was Pinto (1938) justified in ascribing this record to typical *climacocerca*.

265. Nyctidromus albicollis albicollis (Gmelin)

Type locality: Cayenne

Recorded from every collecting locality in our area

5 ♂, Rio Tapajoz, various localities.
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)
4 ♀, Rio Tapajoz, Apaçy (do.)

266. Nyctiphrynus ocellatus ocellatus (Tschudi)

Type locality: Peru

1 ♀, Rio Tapajoz, Boim (Snethlage)
1 ♀, Rio Tapajoz, Tauary (M.C.Z.)

As shown in our revision (1937) this rare Whippoorwill is represented by *brunnescens* Griscom and Greenway in southern Brazil and by *lautus* Miller and Griscom in Central America.

267. Nyctipolus nigrescens nigrescens (Cabanis)

Type locality: British Guiana

Pará (Natterer and Wallace); Utinga (Pinto); Rio Acará, Rio Tocantins, Rio Tapajoz, Rio Jary, Rio Jamundá (Snethlage)

3 ♂ 1 ♀, Rio Tapajoz, Pinhel and Caxiricatuba
1 ♂, Obidos (Carnegie Mus.)
2 ♂, Santarem (do.)
1 ♀, Rio Tapajoz, Villa Braga (do.)

See Griscom and Greenway, 1937, for our understanding of racial variation in this species.

268. Caprimulgus rufus rufus Boddaert

Type locality: Cayenne
Pará (Natterer); Santarem (Pinto)
2 ♂, Rio Tapajoz, Tauary and Pinhy
6 ♂, Santarem (Carnegie Mus.)

As we understand it, true *rufus* is restricted to the Guianas and northeastern Brazil, south possibly to Bahia. Still further south we find a paler less rufescent bird, for which the name *rutilus* Burmeister is probably correct.

269. Caprimulgus sericeocaudatus (Cassin)

Type locality: South America, Brazil or Venezuela
1 ♀, Santarem, Nov. 6, 1919 (Carnegie Mus.)

This Caprimulgus is definitely known only from the type, which is presumably a male. The female, listed above, probably belongs here, when due allowance is made for the sex differences known in the related species of the genus. The holotype has not, however, been examined in the present connection.

270. Caprimulgus maculicaudus (Lawrence)

Type locality: Pará
Pará (Hellmayr, Stone); Rio Acará (Hellmayr); Marajo Island and Arumanduba (Snethlage)
1 ♂, Marajo Island (Linden in M.C.Z.)
2 ♂ 1 ♀, Santarem (do.)
1 ♂, Obidos (Carnegie Mus.)
12 ♂ 6 ♀, Santarem (do.)

This species is still rare in collections. Hartert in the Cat. Birds Brit. Mus., **16**, p. 575, gave its range as the Andes from Colombia to Peru, regarding Lawrence's type locality as incredible. Hellmayr's notes on this species (1907, p. 397) should be consulted.

271. Caprimulgus parvulus parvulus Gould

Type locality: Rio Parané
Pará, Benevides, Rio Xingú (Snethlage); Santarem (Chapman and Riker)
1 ♂ imm., Pará, Bosque
1 ♀, Santarem (Carnegie Mus.)

Family MICROPODIDAE

272. Chaetura spinicauda spinicauda (Temminck)

Type locality: Cayenne
1 ♀, Obidos (Carnegie Mus.)

273. Chaetura spinicauda aethalea Todd, 1937.

Type locality: Benevides, Pará, Brazil.
Pará (Layard and Natterer); Santarem (Wickham)
6 ♂ 1 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)

274. Chaetura brachyura Jardine

Type locality: Tobago
Pará (Layard and Snethlage)
2 ♂ 1 ♀, Rio Tapajoz, Apaçy, Itaituba (Carnegie Mus.)

275. Chaetura chapmani subsp.

1 ♂ Benevides (Carnegie Mus.)

In default of comparative material, no subspecific identification is attempted.

276. Reinarda squamata squamata (Cassin)

Type locality: British Guiana
1 ♂ Santarem (Carnegie Mus.)

277. Panyptila cayannensis (Gmelin)

Type locality: Cayenne
Nazaré (Layard); Pará (Stone); Pará, Apehu, Rio Jamundá (Snethlage)

Family TROCHILIDAE

278. Threnetes leucurus medianus Hellmayr

Type locality: Tury-assu, Maranhao, Brazil
Pará and S. Antonio do Prata (Hellmayr); Snethlage for both these localities; Pará, Rio Inhangapy (Stone)

This recently proposed form (1929, p. 381) connects the two supposed species *leucurus* and *cervinicauda*, but is a geographic extreme. Hellmayr refers Rio Madeira birds to typical *leucurus* of the Guianas.

279. Glaucis hirsuta hirsuta (Gmelin)

Type locality: northeastern Brazil

Pará (Layard, Hellmayr, Snethlage, Stone); S. Antonio do Prata (Hellmayr); Marajo Island (fide Simon); Utinga, Murutucu (Pinto)

1 ♂, Benevides, (Carnegie Mus.)

2 ♂, Rio Tapajoz (do.)

The Benevides bird does *not* differ from Guiana specimens.

280. Glaucis hirsuta subsp.

1 ♂ imm., north bank of Amazon near Obidos

As Hellmayr has correctly remarked, the racial variation of this species is still unsettled in eastern South America, due to inadequate material. Five specimens from Surinam differ from true *hirsuta* in two characters claimed for *roraimæ* Boucard by Simon, the brighter rufescent chest contrasted with the paler belly and the more extensive black subterminal area on the outer rectrices. Specimens from Trinidad and Grenada do not show these characters, however, and we can see no difference between them and a typical *hirsuta*. Our one bird from the north bank of the Amazon is intermediate between *hirsuta* and the Surinam birds in the characters mentioned, but is almost as dark below as *affinis* from Panama and north Colombia.

There are also nomenclatural difficulties. The earliest name for any race north of the Amazon would be *mazeppa* (Lesson) from "Guiana". A study of the colored plate and description, however, in comparison with the description and plate of *hirsuta* (what Lesson called erroneously the ♀ of *Trochilus superciliosus* L.) strongly arouses suspicion that it might be a much earlier name for *Heteroglaucis philippinae* Penard, the proper status of which still remains to be determined.

281. Phoethornis superciliosus superciliosus (Linnæus)

Type locality: Cayenne

Rio Jary, San Antonio do Cachoeira (Snethlage)

2 ♂, Obidos (Carnegie Mus.)

282. Phoethornis superciliosus mülleri Hellmayr

Type locality: Pará

San Antonio do Prata, Pará, Rio Inhangapy (Stone); Peixe-Boi, and Ipitinga (Hellmayr); Mocajatuba, Ananindeua, Santa Isabel, Rio Mojú, Rio Tocantins (Snethlage); Murutucu (Pinto)

1 ♀, Pará, Bosque
2 ♀, Rio Acará, Buenos Aires
2 ♂, 1 ?, Rio Tapajoz, Pinhy and Tauary
1 ♂, Benevides (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Miritituba (do.)

283. Phoethornis superciliosus insignis Todd, 1937

Type locality: Itaituba, left bank Rio Tapajoz, Brazil

5 ♂ 1 ♀, Rio Tapajoz, Villa Braga and Itaituba, (Carnegie Mus.)

A well marked subspecies, presumably ranging west to the right bank of the Rio Madeira. Across that river to the Rio Solimoes we find *ochraceiventer* Hellmayr, and still further west *moorei* Lawrence. The distribution of the species on the north bank of the Amazon is still practically unknown.

284. Phoethornis bourcieri bourcieri Lesson

Type locality: Brazil

1 ♂, Rio Tapajoz, Caxiricatuba

This species has been completely overlooked in our area, and in spite of the type locality, the only record for Brazil is Natterer's from Marabitanas on the Rio Negro. Birds passing as *bourcieri* are now well known from the Peruvian, Ecuador and Colombian Amazons, much rarer northeastward to the Guianas. These latter birds are all strikingly different from our specimen from the Rio Tapajoz and an east Ecuador series, in being much less white and grey below, the underparts almost uniform pale mouse brown, paler on chin, throat and belly, instead of whitish and greyish with a faint brownish tinge on the sides. Thanks to the authorities of the American Museum we have examined ample material listed below. The two races are as follows:

1. typical *bourcieri* (Lesson). We designate Rio Tapajoz as a more restricted type locality. Whiter and greyer below. One record from lower Amazonia; 10 ♂ 2 ♀ from Amazonian Ecuador belong here also,

and possibly the Rio Negro specimen described by Pelzeln as *Ametrornis abnormis, nec* Reichenbach *nomen nudum.*

2. *whitelyi* Boucard, 1891, ex British Guiana. Below nearly uniform pale mouse brown. 4 specimens from British and Dutch Guiana, 1 ♂ from Mt. Duida, Venezuela. 4 ♂ from Caquetá, Colombia are intermediate.

This name, *Phaethornis whitelyi* Boucard, Hummingbird, **1**, 1891, p. 18 (British Guiana) must not be confused with *Eremita whitelyi* Boucard, Genera Hummingbirds, 1895, p. 390 (Kanuku Mts., British Guiana) which is a synonym of *episcopus* Gould, now a race of *ruber.*

285. Phoethornis rupurumii amazonicus Hellmayr

Type locality: Santarem

Santarem (Hellmayr); Rio Tapajoz, Arumanduba, Monte Alegre (Snethlage); Obidos (Hellmayr)

4 ♂ 1 ♀, north bank of Amazon near Obidos
4 ♂ 1 ♀, Rio Tapajoz, Santarem and adjacent localities
4 ♂, Santarem (Carnegie Mus.)

286. Phoethornis ruber ruber Linnæus

Type locality: Surinam

Pará (Layard, Stone); S. Antonio do Prata and Peixe-Boi (Hellmayr); Providencia, Ananindeua, Maguary, Sta. Isabel, Quatipuru, Rio Tocantins, Rio Tapajoz (Snethlage); Santarem (Hellmayr); Murutucu, Utinga (Pinto)

1 ♂, Pará, Bosque
4 ♂, Rio Tapajoz, various localities
1 ♀, Santarem (Carnegie Mus.)

287. Campylopterus largipennis largipennis (Boddaert)

Type locality: Cayenne

1 ♂, Obidos (Carnegie Mus.)

288. Campylopterus largipennis obscurus Gould

Type locality: Amazon valley

Pará (Layard, Wallace, Hellmayr, Stone); S. Antonio do Prato (Hellmayr); Castanhal, Rio Inhangapy (Stone, Snethlage); Peixe-Boi (Hellmayr); Mocayatuba, Apehu, Sta. Isabel, Benevides, Rio Mojú, Marajo Island (Snethlage); Utinga, Murutucu (Pinto)

5 ♂ 4 ♀, 3?, Pará, Bosque
1 ♂ 2 ♀, Rio Acará, Acara and Buenos Aires
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, 1 ? Rio Tapajoz, Miriti tuba, Itaituba, Apaçy (Carnegie Mus.)

This well known hummer only differs from *largipennis* (Boddaert) of the Guianas in having narrower white tips to the lateral rectrices. It has a remarkably restricted range in northeastern Brazil. This species is as yet unrecorded between the Rio Acará and the Rio Madeira, where *aequatorialis* Gould is supposed to occur. The specimens in the Carnegie Museum prove that this disposition of the case is unsatisfactory. The Rio Purus birds agree with *aequatorialis* in two important particulars: (1) the underparts are a lighter grey, almost white on the belly and (2) the tail tips are white, not greyish, and much wider, especially the next to the outermost. The tail above, however, is coppery green, not bluish green as in *aequatorialis*. The Tapajoz bird has the same tail tips as the Purus birds and *aequatorialis* but is otherwise like *obscurus*.

289. Eupetomena macroura macroura (Gmelin)

Type locality: Cayenne

Para, Ilha das Oncas, Monte Alegre (Snethlage); Mexiana Island (Wallace and Hagmann); Marajo Island (Hellmayr, Snethlage, Pinto); Santarem (Chapman and Riker)

1 ♂, Santarem (Carnegie Mus.)

290. Florisuga mellivora (Linnæus)

Type locality: Guiana

Pará (Layard, Wallace, Stone); Rio Inhangapy (Stone); S. Antonio do Prata, Peixe-Boi and Ipitinga (Hellmayr); Benevides, Sta. Isabel, Rio Guamá, Marajo Island, Rio Tocantins (Snethlage)

2 ♂ 1 ♀, Pará, Bosque

4 ♂ 1 ♀, Rio Tapajoz, various localities

1 ♀, Benevides (Carnegie Mus.)

2 ♂, Rio Tapajoz, Apaçy (do.)

291. Agyrtrina versicolor nitidifrons (Gould)

Type locality: Pará

S. Antonio do Prata and Ipitinga (Hellmayr); Rio Tocantins (Snethlage), either this or the next race

1 ♂, Rio Tapajoz, Tauary

1 ♀, Santarem (Carnegie Mus.)

This race of the common *versicolor* of central and southern Brazil occupies a very restricted area from the south side of the mouth of the Amazon to Ceará, Piauhy and Maranhao.

292. Agyrtrina versicolor subspecies

5 ♂ 10 ♀ 2 ?, near Obidos
1 ♀, Obidos (Carnegie Mus.)

Characters. Connecting A. *milleri* (Bourcier) of the Rio Negro northwestward with *versicolor nitidifrons* (Gould) of Pará; throat and breast pure white as in *milleri,* instead of glittering green as in *nitidifrons;* crown plaque nearly pure green, not bluish green as in *milleri,* and restricted as in *nitidifrons;* bill short, 13.5–15 mm. as in *nitidifrons,* instead of 16–16.5 mm. as in *milleri.*

Remarks. Specific lines have been greatly overdone in this genus, as with so many other groups of Hummingbirds. Hellmayr (Birds Northeast Brazil, p. 396) has recently shown that *nitidifrons* and *versicolor* are conspecific, and in a valuable footnote on Simon's types of *meracula* and *laglaizi,* alludes to *milleri* as a subspecies also, without, however, assigning any definite reasons. The present form, also a geographic intermediate, provides abundant proof of the correctness of this view. In two specimens in our series of 17 from the region around Obidos, there are two or three glittering green feathers on the otherwise white throat, giving final evidence of complete intergradation in the most striking and obvious difference between *milleri* and *nitidifrons.*

There are hopeless nomenclatural complications due to the indefinite "*nitidifrons meracula*" Simon (Hist. Nat. Troch., pp. 114, 329) and "*milleri laglaizei*" Simon. Simon's concept of specific lines was quite different from that of previous workers. He kept *milleri* and *nitidifrons* as a distinct species, and while giving all the differentiating characters, did not consider that the white versus glittering green throat was the outstanding difference between them. Accordingly *meracula* is briefly diagnosed on p. 114 as differing from *nitidifrons* in having the throat and breast white as in *milleri,* the bill 15 mm. long. The question naturally arises whether our bird from Obidos could possibly be *meracula.* Two footnotes throw important light on this question. Simon knew *meracula* from two sources (1) 2 specimens from the Wiener mission labelled "Napo" [=east Ecuador], but the locality regarded by Simon as erroneous, as the make of the skins suggested Guiana trade-skins. These specimens differ from *nitidifrons* [and incidentally *milleri*] in having green, not bluish green, crown plaques. (2) a bird from the Orinoco, very much bluer, in some feathers wholly blue, suggesting *A. hollandi* Todd, also from Venezuela, a much earlier name.

It will be apparent, therefore, that *meracula* is a vague composite of two elements. The differences between it and *milleri laglaizei* are completely in the air, as far as Simon's treatment is concerned. In these circumstances the name must await more definite application. We note that Hellmayr (loc. cit.) doubts the locality Rio Napo, but Guiana is equally uncertain, the facts being that it would surely be remarkable if this species had completely escaped detection in both regions.

Previous records of this race in our area have been listed as *Agyrtrina milleri*. These are Obidos (Hellmayr) and Rio Jamundá, Faro (Snethlage). Hellmayr's note on his female from Obidos clearly describes the present subspecies. True *milleri* (Bourcier) ranges from the Rio Negro northwestward and northward to Colombia and Venezuela, where further racial variation may prove to take place.

293. Agyrtrina leucogaster leucogaster (Gmelin)

Type locality: Cayenne
Pará (Snethlage)

The typical race of this species ranges from the Guianas to northeastern Brazil, and the poorly defined *bahiæ* Hartert from Pernambuco southward. True *leucogaster* does not appear to be uncommon just south of our area in Maranhao and Piauhy, and the dearth of records near Pará is consequently surprising.

294. Agyrtrina fimbriata fimbriata (Gmelin)

Type locality: Cayenne
Maracá, Monte Alegre, Igarapé de Paituna (Snethlage); Obidos (Hellmayr)
3 ♂, Rio Amazonas, north bank near Obidos

295. Agyrtrina fimbriata nigricauda (Elliot)

Type locality: Bahia
Mexiana Island (Wallace); Marajo Island (Hellmayr); Quati-Puru, Rio Tocantins, Rio Iriri, Rio Tapajoz (Snethlage); near Santarem (Hellmayr, Pinto).
1 ♂, Pará, Bosque
16 ♂ 7 ♀, Rio Tapajoz, various localities

This fine series enables us to complete Hellmayr's recent critique of the variations of this species in eastern South America (cf. Birds Northeast Brazil, p. 394). A series of 36 topotypes from Surinam compared with 8 from British Guiana show that the characters for *nitidicauda* Elliot have no geographic constancy. Hellmayr proves to be more or less right in his assumption that the Amazon is the boundary between true *fimbriata* and *nigricauda,* though all birds from the south bank are intermediate. Thus our three birds from the north bank near Obidos are typical *fimbriata.* The great series from the Tapajoz agrees with *nigricauda* and differs obviously from true *fimbriata* in having pure white under tailcoverts or at most a fine streak of grey at the base of the shaft. All, however, agree with *fimbriata* rather than *nigricauda* in the coloration of the central tail feathers. A specimen from Pará belongs here also, as might be expected, but curiously enough four old specimens, purporting to come from Pernambuco, belong here also. They are trade skins with no data and of course may not have come from the immediate vicinity of Pernambuco. We see no basis for proposing an intermediate race. Hellmayr refers a bird from the Rio Madeira to typical *fimbriata.*

296. Hylocharis cyanus viridiventris Berlepsch

Type locality: Venezuela, Merida

San Antonio and Santarem (Hellmayr)

2 ♂, Rio Amazonas, Lago Cuipeuz near Obidos

1 ♂, Itaituba (Carnegie Mus.)

1 ♀, Santarem (do.)

297. Hylocharis sapphirina (Gmelin)

Type locality: Guiana

Para (Stone); San Antonio (Hellmayr); Pará, Ananindeua, Sta. Isabel, Marajo Island, Rio Tocantins, Rio Tapajoz, Monte Alegre (Snethlage); Utinga (Pinto)

3 ♂ 6 ♂ imm., 1 ♀, Rio Tapajoz, left bank

1 ♂ 1 ♀, Rio Amazonas, Lago Cuipeuz near Obidos

2 ♂ imm., Pará, Bosque

1 ♂ 2 ♀, Rio Tapajoz, Itaituba (Carnegie Mus.)

298. Chlorestes notatus cyanogenys (Wied)

Type locality: eastern Brazil

Pará (Hellmayr, Layard, Wallace, Snethlage, Stone); S. Antonio do Prata (Hellmayr); Mexiana Island (Hagmann); abundant throughout (Snethlage); Obidos (Hellmayr); Santarem (Chapman and Riker)

10 ♂ ad., 4 ♂ imm., 6 ♀, Rio Tapajoz, east bank
9 ♂ ad., Rio Amazonas, Lago Cuipeuz
10 ♂ imm., Pará, Bosque
2 ♂, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂, Rio Tapajoz, Itaituba (do.)

This fine series differs very markedly and strikingly from 56 specimens from Surinam, Trinidad and east Ecuador (including certain trade skins, "Demerara", "Guiana", and "Brazil") in being glittering bluish green on most of the underparts, the chin violet passing rapidly to bluish green, only the lower edge of the abdomen glittering green or golden green. This is very different from typical *notatus*, in which the violet chin spot is sharply contrasted with the throat, breast and abdomen, which are green or even golden green, rarely with a faint bluish tinge on the upper throat and sides of neck.

There are unusual nomenclatural points involved. In 1913 Riley described *Chlorostilbon prasinus puruensis*, which two years later (Proc. Biol. Soc. Wash., 1915, p. 179) he showed should be called *Chlorestes caeruleus puruensis*. The race *puruensis* differed supposedly from a small series of skins from Lower Amazonia in having slightly longer bills. This difference proves not to hold, as some birds from the Guianas have bills up to 19 mm., and others from upper Amazonian Ecuador have shorter bills than Riley's Rio Purus birds. With *puruensis* transferred to *Chlorestes*, it must, however, be considered with the recognition of an Amazonian race. It is preoccupied several times over. The earliest name is *eyanogenys* Wied, renamed *wiedi* Lesson, whose description emphasizes the bluish green throat. *Agyrtria meliphila* Pelzeln, Rio Negro, possibly belongs here, and *Eucephala subcaerulea* discussed below, comes next in chronological order!

We have examined the unique *Eucephala subcaerulea* Elliott in the American Museum. In this bird the violet chin passes into a deep blue throat and chest, and the underparts do not become bluish green until the center of the abdomen. The skin is of typical "Bahia" make, and as perfectly ordinary *notatus* occurs commonly around Bahia, we are convinced that *subcaeruleus* is a hyperchromatic aberration of *C. notatus eyanogenys* Wied.

The folly of basing ranges and systematic or racial characters upon trade skins is well exemplified in the present connection. The Museum of Comparative Zoölogy happens to have an ample series from authentic localities to check against many trade-skins. Thus a Trinidad series collected by Cherrie at Caparo cannot be separated from those from Surinam in the Penard collection. But a series of trade skins from "Trinidad" are more bluish green below than the series from the south bank of the Amazon; consequently they cannot possibly have come from this island. Another long run of trade-skins from "Brazil" is even more illuminating. "Bahia" trade skins are supposed to have more golden green upperparts and the blue chin spot more sharply defined. There is nothing in this, as some "Bahia" skins before us do not show these characters, and other specimens authentically from Surinam or Trinidad do.

In this connection we may briefly consider the almost unknown *C. hypocyanus* (Gould), the type and one other specimen, both trade skins of Rio or Bahia "make." Many years of exploration have failed to produce either an authentic specimen or a range for this bird. In Hummingbirds this strongly raises the presumption of hybrid origin. Thanks to Gould's beautiful plate, Simon's and Hellmayr's critiques (Novit. Zool., 1908, p. 11) and the utter confusion of generic lines in this group of Hummers, we are able to suggest a possible explanation of *C. hypocyaneus* (Gould). It will be found to be a perfect combination of *Hylocharis cyanus* and *Chlorestes notatus*, both common and occurring over large areas of Brazil together. The more golden green back and coppery upper tailcoverts come from the first parent. The dull crown comes from the second parent, and the glittering blue throat and breast is an exact combination of the violet of *Hylocharis cyanus* and the green or bluish green of *Chlorestes notatus*.

299. Chlorostilbon prasinus prasinus (Lesson)

Type locality: "Brazil", in error, fide Hellmayr

Mexiana Island (Hellmayr); Maracá (Snethlage)

1 ♂, Rio Amazonas, Lago Grande

Lack of material makes it impossible to do anything with this group, the nomenclature and racial variations of which have been thrown into hopeless confusion by Simon. We follow Hellmayr, however, in applying *prasinus* to this species and not to the *aureoventris-pucherani* group with deeply forked tails. In the concept maintained above, *prasinus, subfurcatus* Berlepsch, *brevicaudatus* Gould, *daphne* Gould,

vitticeps Simon, and *peruanus* Gould are all undoubtedly forms of one species, but how many of them are synonyms of each other remains to be finally determined.

300. Thalurania furcata furcata (Gmelin)

Type locality: Cayenne
Obidos (Snethlage)
1 ♂, Obidos (Carnegie Mus.)

301. Thalurania furcata balzani Simon

Type locality: Yungas, Bolivia
Rio Tapajoz, various localities on the left or west bank (Hellmayr and Snethlage)
1 ♂, Rio Tapajoz, Miriti tuba (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

Hellmayr has shown (1910, p. 376) that this form reaches the northern limits of its range on the south side of the Amazon between the Rio Madeira and the Rio Tapajoz. Further west it is replaced by *simoni* Hellmayr along the Rio Solimoes. In central and southeastern Brazil this group is represented by *baeri* Hellmayr and *eriphile* (Lesson).

302. Thalurania furcata furcatoides Gould

Type locality: Pará
Pará (Layard, Wallace, Stone); Rio Inhangapy, Rio Guamá (Stone); Souza, Peixe-Boi, Igarape-Assu, S. Antonio do Prata, Mexiana Island (Hellmayr); Marajo Island and numerous localities near Pará (Snethlage); Rio Tocantins (Snethlage); Utinga, Murutucu (Pinto)
6 ♂ 4 ♀, Pará, Bosque
8 ♂ 3 ♀, Rio Tapajoz, various localities east bank.
1 ♂ 1 ♀, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)

The Pará birds are topotypes of *furcatoides* Gould, as Hellmayr showed years ago. Our series from the right bank of the Tapajoz is inseparable from the Pará series. Both series show conclusively that the characters of *intermedia* Snethlage from the Rio Tocantins are those of younger males, such specimens occurring both in our Pará and Rio Tapajoz series. We have here a welter of species which are really races. In the far west *nigrofasciata* (Gould), *tschudii* Gould, and *jelskii* Taczanowski are three obvious representative forms, which are

connected with the whole *furcata* complex of eastern South America by *balzani* Simon and *simoni* Hellmayr. The *colombica-fannyi* series comes perilously close to the western extremes discussed above, and *watertoni* (Bourcier) is little more than a remarkable long-tailed extreme of the eastern group of subspecies.

303. Avocettula recurvirostris (Swainson)

Type locality: Cayenne

S. Antonio do Prata (Hellmayr); Monte Alegre, Rio Tocantins (Snethlage); Rio Guamá (Stone); Santarem (Pinto)

1 ♂ ad., 4 ♂ imm., 1 ♀, Rio Amazonas. Lago Cuipeuz

304. Anthracothorax viridigula (Boddaert)

Type locality: Guiana

Pará (Stone); S. Antonio do Prata (Hellmayr); Cunany, Monte Alegre, Pará (Snethlage); Mexiana Island (Wallace)

1 ♀, Rio Amazonas, Boca do Igarapé Piaba

2 ♂ 7 ♀, Obidos (Carnegie Mus.)

1 ♂ ad. 1 ♂ imm., Santarem (do.)

Apparently all previous records from Brazil are from Pará and possibly Maranhao.

305. Anthracothorax nigricollis nigricollis (Vieillot)

Type locality: Brazil

Pará (Layard); S. Antonio do Prata, Rio Acará (Hellmayr); Mexiana Island (Hagmann and Wallace); Marajo Island, Itacuan, Rio Tocantins (Snethlage)

5 ♂ 11 ♀, Rio Tapajoz, various localities

1 ♂ 1 ♀, Rio Amazonas, Boca do Igarapé Piaba

3 ♂ ad., 1 ♂ imm., Santarem (Carnegie Mus.)

Excellent series from all parts of the range of this species fail to show any constant geographic variation. It is apparent from the data above, that the two species occur together in the same locality. There is presumably some ecological or habit requirement separating them which remains to be discovered.

306. Chrysolampis elatus (Linnæus)

Type locality: Cayenne

S. Antonio do Prata (Hellmayr); Pará (Snethlage)

1 ♂ imm., north bank of Amazon near Obidos

307. Psilomycter theresiae theresiae (Da Silva)

Type locality: Pará

Pará (Cabanis and Heine); S. Antonio do Prata (Hellmayr); Sta. Isabel, Rio Xingú, Rio Tapajoz (Snethlage)

7 ♂ 1 ♀, Rio Tapajoz, Pinhy
1 ♂ 2 ♀, Benevides (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

This subspecies ranges up the Amazon to the Rio Madeira and Manaos, replaced westward and northwestward by *leucorrhous* (Sclater and Salvin).

308. Polytmus guainumbi thaumantias (Linnæus)

Type locality: Sergipe, northeast Brazil

Marajo Island (Snethlage)

This hummer has a predilection for more open country and is absent from the forested Amazon valley.

309. Topaza pella microrhyncha Butler

Type locality: Utinga, Pará, Brazil

S. Antonio do Prata, Ipitinga (Hellmayr); Mocajatuba, Apehu, Rio Mojú, Rio Acará (Snethlage); Pará, Castanhal, Rio Muraiteua (Stone)

1 ♀, Pará, Bosque
1 ♀, Benevides (Carnegie Mus.)

Now a very uncommon species, the race unknown outside the localities recorded above.

310. Heliothrix auritus auritus (Gmelin)

Type locality: Cayenne

2 ♀, Obidos (Carnegie Mus.)

311. Heliothrix auritus phainolaema Gould

Type locality: Pará

Igarape-Assu, S. Antonio do Prata, Peixe-Boi (Hellmayr); Pará, Providencia, Rio Gurupy, Rio Tocantins, Rio Jamauchim (Snethlage); Rio Inhangapy (Stone)

1 ♂, Rio Tapajoz, Caxiricatuba
1 ♂, Benevides (Carnegie Mus.)
1 ♀, Santarem (do.)
1 ♀, Rio Tapajoz, Aveiros (do.)

The subspecific variation of this species is relatively unusual, as *auriculatus* (Nordmann) not only occurs in Brazil just south of our area, but also in the Amazon valley on the Rio Madeira.

312. Anthoscenus longirostris longirostris

(Audebert and Vieillot)

Type locality: Trinidad
Rio Jamundá, Faro and Rio Tocantins (Snethlage); Santarem (Pinto)

313. Calliphlox amethystina (Gmelin)

Type locality: Cayenne
Pará (Stone); S. Antonio do Prata (Hellmayr); Rio Tocantins (Snethlage)
1 ♂ 1 ♀, north bank of Amazon near Obidos

A species of the Guianas and Venezuela, apparently rare in our area, again common southward.

314. Lophornis gouldii (Lesson)

Type locality: Pará
S. Antonio do Prata (Hellmayr); Providencia, Bragança, Rio Guamá, Rio Tocantins (Snethlage); Utinga (Pinto)
1 ♀, Pará, Bosque
1 ? , Rio Acará, Buenos Aires
1 ♂ imm., Benevides (Carnegie Mus.)

Outside our area this species is definitely known from Maranhao only. The indefinite record "Matto Grosso" by Pelzeln requires confirmation.

315. Discosura longicauda (Gmelin)

Type locality: Cayenne
S. Antonio do Prata (Hellmayr); Rio Tocantins, Cametá (Snethlage)

Family TROGONIDAE

316. Pharomachrus pavoninus viridiceps

Griscom and Greenway, 1937.

Type locality: Lower Amazon, Brazil
1 ♀, Rio Tapajoz, Tauary

Readily distinguishable from true *pavoninus* of far upper Amazonia. The specimen listed above is quite the easternmost locality of record for the species.

317. Trogon collaris Vieillot

Type locality: Cayenne

Rio Jary and Rio Jamauchim (Snethlage); "lower Amazons" (Wallace in Brit. Mus.)

2 ♂ 2 ♀, Rio Tapajoz, Miriti tuba and Villa Braga (Carnegie Mus.)

To be perfectly clear on vexed matters of nomenclature, this species is the *T. curucui* Linnaeus of Hellmayr and Pinto.

318. Trogon curucui curucui Linnæus

Type locality: Cayenne

Obidos, Rio Jamundá, Faro (Snethlage)

1 ♂, Obidos (Carnegie Mus.)

319. Trogon curucui sulphureus Spix

Type locality: Tabatinga, Rio Solimoes, Brazil

S. Antonio do Prata (Hellmayr); Castanhal (Stone); Rio Guamá, Rio Tapajoz (Snethlage)

3 ♂ 2 ♀, Rio Tapajoz, various localities

1 ♂ 1 ♀, Pará, Bosque

2 ♂, Benevides (Carnegie Mus.)

1 ♂ 2 ♀, Santarem (do.)

2 ♂, Rio Tapajoz (do.)

We adopt Ridgway's nomenclature for the vexed question as to the proper name of this species, and we designate Cayenne as the type locality. We also agree with Ridgway as to the racial variation in this species. Hellmayr in his study of Spix's types (p. 596) has already shown that the bird of southern Brazil should be known as *chrysochlorus* Pelzeln. While endorsing the markedly larger size of the southern bird on the basis of specimens before us, we would also report the narrower bars on the outer tail feathers, both black and white. This results in a 50% increase in the total number of bars per tail feather. In the same paper Hellmayr did not regard *sulphureus* Spix as separable, apparently comparing males only. With a fair series from both Surinam and the Lower Amazon, we agree in finding males inseparable. But there is an excellent difference in the tail feather pattern of females. In Amazonian females the solid black basal por-

tion of the inner web of the outermost rectrix is greatly extended, so that there are 2–3 black bars between the solid black area and the pure white tip. In typical *curucui* the solid black area is reduced, resulting in 5–8 black bars before the white tip is reached. The same relative difference exists on the 2nd and 3rd rectrices from the outermost. Finally we would remark that the female of *chrysochlorus* has a similar tail pattern to *sulphureus*, which furnishes still another distinctive character.

320. Trogon strigilatus strigilatus Linnæus

Type locality: Cayenne

Rio Capim (Wallace and Goeldi); Rio Guamá, Rio Inhangapy (Stone); Ipitinga (Hellmayr); Santarem (Chapman and Riker); throughout (Snethlage); Caviana Island (Brodkorb, as *albiventer* of Envier, on highly dubious characters)

8 ♂ 4 ♀, Rio Tapajoz, various localities
1 ♀, Rio Acará, Acará
1 ♂, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

We have compared this series with a very fine one from Surinam, and find no essential difference between these birds, as well as others from Trinidad, the interior of Venezuela and upper Amazonian Ecuador. Birds from eastern Brazil are, however, an easily recognizable subspecies. Females have greatly reduced white tips to the outer rectrices and there is a marked difference in size; ♀ from Surinam, 140–149 mm., from Bahia, 155–159 mm. Of the various names applied to this Trogon, all are clearly synonyms of true *strigilatus* except *melanopterus* Swainson, which was for a brief period applied to the species as a whole, before the Linnæan names were identified. This name is based on a male collected by Swainson himself while in Brazil. The description is a very brief one and is not subspecifically identifiable. The only possible clue, the length of the wing, is entirely unsatisfactory, as the measurement given is smaller than the smallest Surinam bird in our series. Swainson's travels in Brazil were (1) around Pernambuco, (2) around Bahia, and (3) Rio de Janeiro. It will be apparent, therefore, that the chances are very great that he had the larger east Brazil race. We consequently designate Bahia as a more restricted type locality, and the southern form will be known as *T. strigilatus melanopterus* Swainson.

321. Trogon variegatus variegatus Spix

Type locality: Brazil
Cajutuba (Natterer)

The only record for this "campo" form in our area.

322. Trogon variegatus bolivianus Grant

Type locality: Cosnipata, Peru
Rio Tapajoz, Goyana on west bank
1 ♀, Rio Tapajoz, Apacy (Carnegie Mus.)

There is still some confusion in the races of *variegatus*. According to Hellmayr, the present form ranges from northern Bolivia to eastern Colombia, east to the Tapajoz. This far outlying station is connected with the rest of the range only by records from Matto Grosso, which Mrs. Naumburg refers to *behni* Gould, a much more austral form according to Hellmayr. It is remarkable that the species should occur at all in our area, and that the only two specimens come from opposite ends of it, and belong to two different subspecies.

323. Trogon violaceus crissalis (Cabanis and Heine)

Type locality: Bahia, in error
Pará (Goeldi, Brigham, Stone); Ipitinga (Hellmayr); Benevides, Rio Guamá, Rio Tocantins, Rio Xingú, Rio Tapajoż, Rio Jamauchim, Obidos (Snethlage); Santarem (Chapman and Riker)
1 ♂ 1 ♀, Rio Tapajoz, Santarem and Caxiricatuba
1 ♀, Rio Acará, Acará
1 ♂ imm., Santarem (Carnegie Mus.)
2 ♂, Rio Tapajoz, Apaçy (do.)
1 ♂, Benevides (do.)

The racial variation of this species in eastern Brazil still awaits final determination, and the subspecific name used above is tentative only. The very few records from northeastern Brazil have been called *ramonianus* Deville and Desmurs, a name based on a bird from northeast Peru, and which occurs along the base of the eastern Andes in Ecuador. The birds before us agree with *ramonianus*, and differ from the *violaceus-caligatus* series, in having the blackish, very minutely freckled wing-coverts. They differ from true *ramonianus* of eastern Ecuador in having smaller bills. This is one of the characters assigned by Ridgway to *crissalis* Cabanis and Heine, based on a "Bahia" trade

skin. The character of the relative amount of freckling on the wing coverts is *reversed* in our specimens, so it is apparently worthless. Ridgway saw only one bird from Pará, and assuming that the Bahia bird would not be the same, proposed *goeldii* for the Para bird, should it prove different! The probabilities are, however, that *crissalis* did *not* come from Bahia, as there is no authentic record of the species south of Amazonian drainage. The chances consequently are that the type of *crissalis* will prove to represent lower Amazonian birds, and that Ridgway's *goeldii*, proposed without any proper diagnosis, will be reduced to the synonymy it so richly deserves.

324. Trogon melanurus melanurus Swainson

Type locality: Guiana

Pará (Natterer, Wallace, Stone); Rio Guamá (Stone); Peixe-Boi and S. Antonio do Prata (Hellmayr); Rio Iriri, Cussary, Monte Alegre, Obidos, Rio Jamundá, Marajo Island (Snethlage); Santarem (Riker and Chapman)

3 ♂ 2 ♀, Amazon river near Obidos, various localities
2 ♂ 1 ♀, Rio Tapajoz, various localities
1 ♂, Obidos (Carnegie Mus.)
2 ♀, Santarem (do.)
5 ♂, Rio Tapajoz, Villa Braga (do.)

Family ALCEDINIDAE

325. Ceryle torquata cyanea (Vieillot)

Type locality: Paraguay

3 ♀, Rio Tapajoz
1 ♂ 4 ♀, Amazon River near Obidos
1 ♂, Santarem (Carnegie Mus.)

Numerous records throughout the region.

326. Chlorocervle amazona (Latham)

Type locality: Cayenne

2 ♂ 2 ♀, Amazon River near Obidos
3 ♀, Rio Tapajoz
1 ♂, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Santarem (do.)

Numerous records throughout the region.

327. Chlorocervle americana americana (Gmelin)

Type locality: Cayenne
1 ♀, Amazon River near Obidos
3 ♂ 3 ♀, Rio Tapajoz
1 ♀, near Pará, Val-de-Caes
2 ♂ 2 ♀, Santarem (Carnegie Mus.)
3 ♀, Rio Tapajoz, Apaçy (do.)

Numerous records throughout the region.

328. Chlorocervle inda (Linnæus)

Type locality: Cayenne
3 ♂, Rio Tapajoz, Pinhy
1 ♀, Benevides (Carnegie Mus.)

Numerous records throughout, including Caviana Island (Brodkorb).

329. Chlorocervle aenea aenea (Pallas)

Type locality: Surinam
3 ♂ 2 ♀, Amazon River near Obidos
5 ♂ 3 ♀, Rio Tapajoz, various localities
1 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
4 ♂ 2 ♀, Rio Tapajoz (do.)
1 ♂, Santarem (do.)

Numerous records throughout.

Family MOMOTIDAE

330. Baryphthengus martii martii (Spix)

Type locality: Pará
Rio Tapajoz, Villa Braga (Snethlage)
2 ♂, Rio Tapajoz, Tauary and Caxiricatuba
2 ♀, Santarem (Carnegie Mus.)
2 ♂ 3 ♀, Rio Tapajoz, various localities (do.)

The right bank of the Rio Tapajoz marks the eastern extension of the range of this species in Brazil. It has been taken on the Rio Purus and the Rio Madeira.

331. Momotus momota momota (Linnæus)

Type locality: Cayenne
Obidos (Hellmayr, Snethlage, Pinto); Monte Alegre and Rio Jamundá (Snethlage)
5 ♂ 5 ♀, Obidos (Carnegie Mus.)

The north bank of the Amazon marks the southern limit of the typical form.

332. Momotus momota parensis Sharpe

Type locality: Pará
8 ♂ 4 ♀, Pará and Rio Acará
2 ♂ 2 ♀, Benevides (Carnegie Mus.)

Recorded by all collectors from Pará to the right bank of the Rio Tocantins, and extending southward into Maranhao and Piauhy. Its absence from Mexiana and Marajo Islands should be particularly noted. On the left bank of the Rio Tocantins we find *cametensis* Snethlage, which will presumably range west to the right bank of the Rio Xingú. From the Rio Tapajoz west to the Rio Purus, it is replaced by *simplex* Chapman.

333. Momotus momota cametensis Snethlage

Type locality: Cametá, Rio Tocantins
Rio Tocantins, Cametá and Araumatheua (Snethlage)
3 ♂ 2 ♀, Rio Tocantins, Cametá

These birds are topotypes of *cametensis*, of which Chapman had no specimens when he reviewed the group (Bull. Amer. Mus. Nat. Hist., (48), 1923, p. 45). Three show perfectly the characters ascribed to the race, and are, indeed, astonishingly distinct from *parensis* and *simplex*. Two are indistinguishable from *parensis*, and arouse suspicion as to whether some mislabelling has not occurred.

334. Momotus momota simplex Chapman

Type locality: Santarem
Santarem (Chapman and Riker, Hellmayr)
8 ♂ 4 ♀, Rio Tapajoz, various localities
5 ♂ 5 ♀, Rio Tapajoz, various localities (Carnegie Mus.)
5 ♂ 7 ♀, Santarem (do., including type)

335. Electron platyrhynchum orientale Todd, 1937

Type locality: Villa Braga, left bank, Rio Tapajoz, Brazil
1 ♂ 1 ♀, type locality (Carnegie Mus.)

At the time Mr. Todd and we were working on the Carnegie Museum collections, all completely overlooked Miranda Ribeiro's description of *chlorophrys* from the Rio Tocantins in Goyaz and Tramagin, Matto Grosso. There is, of course, the possibility that the two subspecies might be the same, but it is impossible to guess from the original diagnosis of *chlorophrys*, the main characters used being true of any immature Electron as compared with any adult!

Family GALBULIDAE

336. Urogalba dea dea (Linnæus)

Type locality: Surinam
7 ♂ 3 ♀, Obidos (Carnegie Mus.)

337. Urogalba dea amazonum Sclater

Type locality: upper Amazonia
1 ♀, Pará, Bosque
5 ♂ 1 ♀, Rio Tapajoz, various locality
9 ♂ 5 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
12 ♂ 6 ♀, Rio Tapajoz, right bank (do.)
1 ♂ 2 ♀, Rio Tapajoz, left bank (do.)

Recorded throughout our area, except Mexiana and Marajo Islands. These birds differ strikingly from a series of typical *dea* from Surinam in just the respects ascribed to *amazonum*. We have, however, no upper Amazonian material for comparison.

338. Galbula galbula Linnæus

Type locality: Brazil
Obidos (Hellmayr and Snethlage); Rio Jamundá, Monte Alegre, Ereré, Paituna, Rio Maecuru, Rio Jary, Arumanduba, Cunani (Snethlage); Santarem (Chapman and Riker) and Rio Tapajoá (Snethlage)
1 ♂ 3 ♀, north bank of Amazon near Obidos
3 ♂ 3 ♀, Obidos (Carnegie Mus.)
6 ♂ 7 ♀, Rio Tapajoz (do.)

339. Galbula rufoviridis rufoviridis Cabanis

Type locality: Brazil

Rio Guamá (Stone); Marajo Island, Rio Tocantins, Rio Tapajoz, Rio Jamauchim (Snethlage); Rio Tocantins (Wallace); Santarem (Chapman and Riker); also Monte Alegre (Snethlage); Caviana Island (Brodkorb).

4 ♂ 2 ♀, Pará (Val-de-Caes)
13 ♂ 7 ♀, Santarem (Carnegie Mus.)

It is quite surprising that there are no previous records of this common Jacamar from the vicinity of Pará. It ranges west to the Rio Madeira.

Snethlage, alone, reports *rufoviridis* from Monte Alegre. One wonders if she did not really have transitional or atypical specimens.

340. Galbula albirostris albirostris Latham

Type locality: Guyana

Obidos (Hellmayr and Snethlage)

9 ♂ 6 ♀, Obidos (Carnegie Mus.)

Obidos is the southern limit of this species, which doubtless occurs elsewhere on the north bank of the Amazon. West of the Rio Negro it is represented by *chalcocephala* Deville.

341. Galbula cyanicollis Cassin

Type locality: Pará

8 ♂ 5 ♀, Rio Tapajoz, various localities
3 ♂ 1 ♀, Pará, Val-de-Caes
6 ♂ 5 ♀, Santarem (Carnegie Mus.)
6 ♂ 4 ♀, Rio Tapajoz (do.)

Recorded by all collectors throughout our area on the south side of the Amazon, but absent on Mexiana and Marajo Islands. It ranges westward to the Rio Jurua and Rio Purus.

342. Galbula leucogaster leucogaster Vieillot

Type locality: Guiana

Rio Maecuru, Cachoeira (Snethlage)

This species has never been recorded from the south bank of the Amazon, where it is represented by the recently described form below.

343. Galbula leucogaster viridissima
Griscom & Greenway, 1937

Type locality: Rio Tapajoz, Pinhy
3 ♂ 1 ♀, type locality
2 ♂ 1 ♀, Rio Tapajoz, both banks (Carnegie Mus.)

As shown in the original description *chalcothorax* is merely another representative form of this species.

344. Brachygalba lugubris lugubris (Swainson)

Type locality: Brazil
Monte Alegre, Rio Maecuru, Rio Acara (Snethlage); Rio Tocantins (Wallace and Snethlage)
2 ♂ 2 ♀, Pará, Val-de-Caes

Until very recently a very little known bird in Brazil. So far as we know adequate series from Guiana and Brazil have never been compared.

345. Brachygalba lugubris melanosterna Sclater

Type locality: Goyaz
Rio Curua (Snethlage)

This record, just within our limits, marks the extreme northern limit of the subspecies, which ranges from central Brazil southward. In fact typical *lugubris* ranges south of the Rio Curua, further eastward in Parnahyba. Both forms are represented by *fulviventris* in Amazonian Colombia and Ecuador. The species has yet to be collected in the intervening area, but it is sufficiently rare so that the negative evidence to date is by no means conclusive.

[*Brachygalba albigularis* (Spix) was described as from "*sylvis ad urbem Param*". With the exception of the type the only specimens come from the Rio Javari (Bates) and the Rio Purus (Snethlage). There is no reason to suppose that "Pará" is really correct.]

346. Jacamerops aurea aurea (P.L.S. Müller)

Type locality: Guiana
Peixe-Boi (Hellmayr); Rio Capim (Wallace); Rio Guama, Rio Acará, Rio Tapajoz (Snethlage); Pataua (Pinto)
1 ♀, Rio Tapajoz, Pinhy
4 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
1 ♂ 4 ♀, Santarem (do.)
6 ♂ 1 ♀, Rio Tapajoz, left bank (do.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)

There is no appreciable difference between Brazil and Guiana specimens. As usual, birds from upper Amazonia are notably larger, and the name *isidori* Deville based on a bird from Sarayacu, northeastern Peru is available, in spite of the fact that the type is a melanoid. Curiously enough a female from Mt. Duida is inseparable from the type of *penardi* Bangs and Barbour from Costa Rica.

Family BUCCONIDAE

347. Bucco capensis Linnæus

Type locality: Guiana

Pará (Wallace, Snethlage, Stone); Castanhal (Stone); Peixe-Boi (Hellmayr)

1 ♂, Rio Tapajoz, Caxiricatuba
1 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, Villa Braga, Apaçy (do.)

348. Notharcus macrorhynchus paraensis Sassi

Type locality: Pará

Pará (Layard, Natterer, Wallace, Snethlage, Stone); Cajutuba (Natterer); Rio Capim (Goeldi); Rio Tocantins (Sassi)

3 ♂ 2 ♀, Santarem (Carnegie Mus.)

These birds have notably bigger bills than those from the left bank of the Rio Tapajoz, agreeing with the measurements of Pará birds.

349. Notharcus macrorhynchus hyperrhynchus (Sclater)

Type locality: upper Amazonia

1 ♂ 1 ♀, Rio Tapajoz, Itaituba (Carnegie Mus.)

Apparently the upper Amazonian representative of *macrorhynchus* of Guiana, which reaches the Amazon only at Manaos, of which *gigantcus* Pelzeln from Marabitanas, Rio Negro, is presumably a synonym.

350. Notharcus ordii Cassin

Type locality: Venezuela

Rio Cussary (fide Snethlage)

351. Notharcus tectus tectus (Boddaert)

Type locality: Cayenne

Pará (Layard, Natterer, Wallace, Stone); Igarape-Assu and San Antonio do Prata (Hellmayr); Santarem (Chapman and Riker); Rio Guamá, Marajo Island, Monte Alegre, Obidos, Rio Jamundá, Rio Tocantins (Snethlage)

7 ♂ 2 ♀, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Benevides (do.)
6 ♂ 5 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, Apaçy, Itaituba, Villa Braga (do.)

Birds from the south bank of the Amazon differ from Cayenne topotypes in having minutely longer bills, which are also a little broader at the base.

352. Nothurchus macrodactylus macrodactylus (Spix)

Type locality: Fonte Boa, Rio Solimoës, by subs. desig.

1 ♂, Obidos (Carnegie Mus.)

353. Nystactes tamatia tamatia Gmelin

Type locality: Cayenne

Amapa, Arumanduba, Monte Alegre, Ererć, Rio Maecuru, Obidos (Snethlage)

1 ♂ 1 ♀, Obidos (Carnegie Mus.)

354. Nystactes tamatia subsp.

1 ♂ 2 ♀, Rio Tapajoz, left bank, Villa Braga

Surprisingly close to typical *tamatia* in coloration and consequently sharply distinct from *hypnalcus;* resembling the latter, however, in the shorter and slenderer bill, a marked character of that race in good series.

Presumably Hellmayr's record of typical *tamatia* from the *right* bank of the Rio Madeira belongs here also. A series from the Rio Purus has the pale throat of *pulmentum* Sclater, but is not heavily spotted. Very fine series from the Solimoës presumably represent *pulmentum.* There is the possibility that these birds might represent *interior* Cherrie and Reichenberger.

355. Nystactes tamatia hypnaleus Cabanis and Heine

Type locality: Pará
Pará (Natterer); Ipitinga and Rio Acará (Hellmayr) Rio Capim (Wallace); Santarem (Chapman and Riker, Pinto); Rio Tocantins and Rio Tapajoz (Snethlage)
1 ♂ 3 ♀, Pará, Val-de-Caes
2 ♀, Rio Tapajoz, Tauary
12 ♂ 7 ♀, Santarem (Carnegie Mus.)

The four Pará birds are topotypes and are by no means as distinct in color from a good series of typical *tamatia*, as Hellmayr's comments would lead one to infer (cf. Novit. Zool., 1910, p. 391), as three have the black apical breast spots *minutely* larger than the great majority of our *tamatia* series. The 21 birds from the Rio Tapajoz are obviously more heavily marked with black below and very distinct.

356. Nystalus maculatus maculatus (Gmelin)

Type locality: Brazil
Marajo Island and Rio Tapajoz (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)
9 ♂ 9 ♀, Rio Tapajoz, various localities
9 ♂ 7 ♀, Santarem (Carnegie Mus.)

This species is really at the extreme northern limit of its range on the south bank of the Amazon. It is quite variable, there being two other races in Brazil.

357. Nystalus striolatus (Pelzeln)

Type locality: Engenho do Cap Gama
S. Antonio do Prata (Hellmayr and Snethlage); Rio Inhangapy (Stone); Rio Guamá (Stone, Snethlage)

At present this species has a curiously interrupted distribution, the Pará records being quite removed from the balance of the bird's known range in upper Amazonia.

358. Malacoptila fusca (Gmelin)

Type locality: Cayenne
Obidos (Snethlage, Pinto)
6 ♂ 2 ♀, Obidos (Carnegie Mus.)

359. Malacoptila rufa brunnescens Zimmer

Type locality: Caxiricatuba, Rio Tapajoz

Santarem (Chapman and Riker); various localities from the Rio Madeira to the right bank of the Rio Tapajoz (Zimmer)

2 ♂ 6 ♀, Rio Tapajoz, various localities
2 ♂ 3 ♀, Santarem (Carnegie Mus.)
10 ♂ 9 ♀, Rio Tapajoz (do.)

360. Malacoptila rufa subspecies

Pará (Natterer, Wallace); S. Antonio do Prata (Hellmayr); Rio Inhangapy (Stone); Rio Capim (Goeldi); Peixe-Boi (Hellmayr; also numerous localities near Pará, the Rio Tocantins and the Rio Xingú (Snethlage)

For the latest comment on this species cf. Zimmer, Amer. Mus. Novit., no. 500, 1931, pp. 3–7. He there advances reasons for supposing that more than one form of the species may inhabit the region between the Tapajoz and Pará.

361. Monasa atra (Boddaert)

Type locality: Cayenne

Maracá, Cunany, Rio Jary, Obidos, Rio Jamundá (Snethlage); Obidos (Hellmayr)

1 ♂ 2 ♀, near Obidos

362. Monasa morphœus morphœus (Hahn and Küst)

Type locality: Brazil

1 ♀, Pará, Val-de-Caes
1 ♂, Rio Acará, Acará
8 ♂ 6 ♀, Rio Tapajoz, various localities
2 ♀, Benevides (Carnegie Mus.)
11 ♂ 9 ♀, Santarem (do.)
6 ♂ 13 ♀, Rio Tapajoz (do.)

Numerous records from every part of our area south of the Amazon, except Mexiana and Marajo Islands.

We are quite unable to recognize *rikeri* Ridgway from Diamantina and Santarem. Whether the malar apex is black or white is an individual variation in not only the series listed above, but in another modern one from Bahia. The same character has been shown to break down in certain alleged Panama species.

363. Monasa nigrifrons nigrifrons (Spix)

Type locality: Rio Solimoës

3 ♂ 1 ♀, Rio Amazonas, near Obidos
8 ♂ 1 ♀, Rio Tapajoz, various localities
12 ♂ 7 ♀, Santarem (Carnegie Mus.)
7 ♀, Rio Tapajoz (do.)
2 ♂ 2 ♀, Obidos (do.)

Numerous records throughout our area.

364. Nonnula rubecula simplex Todd, 1937

Type locality: Villa Braga, Rio Tapajoz

1 ♂, the type, examined (Carnegie Mus.)

Replaced by *cineracea* Sclater on the Rio Madeira.

365. Chelidoptera tenebrosa tenebrosa (Pallas)

Type locality: Surinam

2 ♂, Pará, Val-de-Caes
1 ♂, Rio Acará, Acará
3 ♂ 2 ♀, Rio Tapajoz, various localities
1 ♂ 1 ♀, Benevides (Carnegie Mus.)
7 ♂, Rio Tapajoz, Apaçy (do.)

Numerous records throughout.

We agree with Hellmayr that birds from the south bank of the Amazon are inseparable from a Surinam series and show no approach to the radically larger and paler *brasiliensis* of eastern and southern Brazil. Wing measurements of males of true *tenebrosa* are 101–108, of *brasiliensis*, 114–116. Properly sexed modern series show that females are decidedly larger than males, a Surinam series, 105–111 mm. There is also a remarkable change in bill length and bill proportions with maturity. Younger birds have much shorter and broader bills, and old adults have not only longer bills, but a long subulate tip or terminal half, entirely lacking in younger stages. Two males from the upper Amazon in northeastern Peru and eastern Ecuador are *tenebrosa* in color, but are as usual larger, 108–113 mm. Should this size difference prove constant in series, the bird of upper Amazonia should be described. There is one very remarkable specimen in the museum collection from Alagoas, Maceio, on the coast 60 miles south of Pernambuco, collected by Newton Dexter. This bird is unsexed, but the wing measures 123 mm. Even assuming that it must be a female, it is gigantic, and strongly indicates the need of further material from this neglected corner of Brazil.

Family CAPITONIDAE

366. Capito brunneipectus Chapman

Type locality: Villa Braga, left bank of Rio Tapajoz
1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

First known from four specimens collected by Snethlage at the type locality, and sent to the American Museum for determination (cf. Chapman, Amer. Mus. Novit., no. 2, 1921, p. 1). It marks the easternmost point reached by the genus. This species and *C. dayi* Cherrie of the Rio Madeira represent the upper Amazonian *C. auratus* Dumont, a variable species recently monographed by Chapman (Amer. Mus. Novit. no. 335). In particular the relationships of *C. dayi* to birds from the Rio Madeira, which Hellmayr (1910, p. 395) reported provisionally as *C. auratus intermedius* Berlepsch and Hartert, and which are possibly *A. auratus insperatus* Cherrie, should be investigated.

367. Capito niger (P.L.S. Müller)

Type locality: Cayenne
Obidos and Rio Jamundá, Faro (Snethlage)

Family RAMPHASTIDAE

368. Ramphastos toco toco (P.L.S. Müller)

Type locality: Cayenne
Mexiana Island (Wallace, Hagmann); Marajo Island and Monte Alegre (Snethlage); Pataua (Pinto)
2 ♂ 2 ♀, Pará, Val-de-Caes
3 ♀, Santarem (Carnegie Mus.)

Lower Amazon birds do not differ from a Cayenne series in the Carnegie Museum. In life *toco* has the bill uniform orange except for the black areas, the ridge of both mandible and maxilla crimson. In dried museum skins the bill fades to a uniform dull yellow, the ridges crimson or orange. Two specimens recently killed on the Rio Iguassu, Paraguay, are remarkable in having the maxilla largely crimson instead of orange, orange only for a narrow black band just forward of the black base; the crimson color increases in intensity and depth towards the tip of the bill. Birds from Sao Paulo are strikingly distinct in having the pure white throat untinged with yellow and constitute a

recognizable race, *albogularis* Cassin. Some birds from Sao Paulo and others from Goyaz are identical with Paraguayan birds in coloration of the bill, while the Paraguayan birds approach *albogularis* in other respects. Specimens from Bolivia in the Carnegie Museum do not show the bill characters of the Paraguayan birds and are inseparable from *toco*.

369. Ramphastos tucanus tucanus Linnæus

Type locality: Cayenne

Amapá and Rio Jamundá (Snethlage); Pará (Natterer, Stone, Wallace); Igarape-assu, Peixe-Boi, and Ipitinga (Hellmayr); Rio Capim (Goeldi); Providencia and Sta. Isabel (Snethlage). Birds from the Rio Xingú (Zimmer), and the Rio Tocantins (Snethlage) approach the next race. Obidos, Murutucu, Pará region (Pinto)

1 ♀, Rio Acará, Acará

1 ♂, Obidos (Carnegie Mus.)

370. Ramphastos tucanus oblitus Griscom & Greenway, 1937

Type Locality: Rio Tapajoz, Tauary

Santarem (Pinto)

1 ♂ (the type, M. C. Z.)

3 ♂ 1 ♀, Santarem (Carnegie Mus.)

This well marked intermediate form will presumably range at least as far east as the left bank of the Rio Xingú. It must be remembered that Pará specimens, while referable to typical *tucanus*, approach this race in having deeper colored under tailcoverts. The distinctness of *oblitus* is best evident when Cayenne topotypes of *tucanus* are used in comparison.

371. Ramphastos tucanus cuvieri Wagler

Type locality: Borba, Rio Madeira, by subsequent designation

Itaituba, left bank of Rio Tapajoz (Snethlage)

1 ♀ imm., Boim, Rio Tapajoz.

372. Ramphastos vitellinus vitellinus Lichtenstein

Type locality: Cayenne

Cunany, Obidos, Rio Jamundá (Snethlage); Obidos (Pinto)

1 ♀, Obidos (Carnegie Mus.)

373. Ramphastos vitellinus ariel Vigors

Type locality: Rio de Janeiro
Numerous records from south side of the Amazon, except the islands

2 ♂ 1 ♀, Rio Acará, Acará
1 ♂ 2 ♀, 1? Rio Tapajoz various localities, both banks.
2 ♂ 3 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 2 ♀, Rio Tapajoz (do.)

This toucan is clearly a mere subspecies of the Guiana *vitellinus*, which it represents on the south side of the Amazon southward to eastern Brazil. It is specifically distinct from *culminatus* in having the ridge of the culmen *black*, concolor with the side of the bill, and occurs together with the *culminatus-osculans* group and the *tucanus* group in one or another part of their ranges. While we appreciate Zimmer's comments on the variations in the color of throat and upper tail coverts, we feel that the two facts mentioned above should have weight, until evidence to the contrary materializes.

374. Pteroglossus aracari aracari (Linnæus)

Type locality: Northeastern Brazil, ex Maregrave
Numerous records from Marajo Island and Pará to the right bank of the Madeira

1 ♀, Rio Acará, Acará
2 ♂ 1 ♀, Santarem (Carnegie Mus.)
2 ♂ 2 ♀, Rio Tapajoz, left bank (do.)
3 ♂ 4 ♀, do. , right bank (do.)

A fair series from Bahia and Rio de Janeiro differ only in averaging minutely paler yellow below. In Sao Paulo we find the very distinct *vergens* Griscom and Greenway, which in color characters approaches *castanotis australis* Cassin so remarkably. Were it not for the fact that these two birds occur together at Valparaiso, Sao Paulo, we should have been inclined to think that *castanotis*, *mariae*, *azarae*, and *aracari* were conspecific.

375. Pteroglossus aracari atricollis (P.L.S. Müller)

Type locality: Brazil in error; Cayenne by Bangs and Penard, 1918
Maracá, Monte Alegre, Obidos (Snethlage)

9 ♂ 2 ♀, north bank of Amazon near Obidos
2 ♂ 3 ♀, Obidos (Carnegie Mus.)

A fine series of Cayenne topotypes in the Carnegie Museum shows that birds from the north bank of the Amazon are *atricollis*. This race

differs from typical *araeari* in having a broad black culminal stripe, and the breast is sulphur to orange yellow instead of lemon yellow.

We have here a further illustration of the rashness of assuming that the "Guianas" (all three colonies) are necessarily a homogeneous unit. Eight specimens from Paramaribo, Surinam, before us are immediately separable from *atricollis* in having lemon yellow breasts as in typical *araeari*, and the thighs more olive, less ochraceous brown. Two birds from eastern Venezuela agree with these Surinam birds. There is every possibility that this subspecies, by pure chance, will have to be known as *roraimae* Brabourne Chubb, a name originally proposed on purely nomenclatural but invalid grounds!

There would appear to be another misunderstanding of nomenclature. Pinto (1938, p. 329, footnote) has claimed that *wiedii* Sturm, 1847, is an earlier name for *vergens* Griscom and Greenway. In the first place, birds from Wied's collecting area, from Bahia south to Rio de Janeiro are typical *araeari;* hence Wied cannot have collected *vergens* a southern race from Sao Paulo. In the second place, the plate and description of *wiedii* Sturm is an excellent characterization of true *araeari*. Gould (Monog. Toucans, 2nd ed., 1854) took up *wiedii* Sturm. His plate and description show clearly that the differences between *araeari* and *wiedii* are exactly the differences between Guiana and Brazil specimens of *araeari*. In other words, Gould and Sturm thought of *araeari* as a Guiana bird, now *aracari atricollis*, and *wiedii*, the east Brazil bird, is a synonym of true *araeari*, originally based on a Maregrave specimen ex northeast Brazil. There are *two* races of this species in Brazil.

376. Pteroglossus bitorquatus bitorquatus Vigors

Type locality: none given: we suggest Pará

Pará (Natterer and Wallace); S. Antonio do Prata and Ipitinga (Hellmayr); Rio Capim (Goeldi); Ourem (W. A. Schulz); Providencia and Benevides (Snethlage); Utinga (Pinto)

1 ♀, Rio Acará, Acará

377. Pteroglossus bitorquatus reichenowi Snethlage

Type locality: Monte Alegre, north bank of Amazon, apparently in error; this locality questioned in Aves do Amazonicas

Rio Tocantins, Cametá and Rio Jamauchim, Sta. Helena (Snethlage); Santarem (Chapman and Riker); Santarem (Pinto)

9 ♂ 8 ♀, Santarem (Carnegie Mus.)

An obvious representative of *bitorquatus*, differing only in the absence of the narrow yellow pectoral band. A specimen in the M.C.Z. with no original label is labelled "Marajo Island," a locality which cannot possibly be correct, as the genus is unknown on the open campos of this island.

378. Pteroglossus bitorquatus sturmi Natterer

Type locality: Borba, Rio Madeira

1 ♀, Rio Tapajoz, Mirituba (Carnegie Mus.)
1 ♂ 1 ♀, (do.) , Apaçy (do.)
2 ♂ 1 ♀, (do.) , Villa Braga (do.)

379. Pteroglossus viridis inscriptus Swainson

Type locality: Guiana in error

Pará (Layard, Natterer, Stone, Wallace); Ipitinga (Hellmayr); Rio Inhangapy (Stone); Santarem (Chapman and Riker, Hellmayr); Providencia, Benevides, St. Antonio do Prata, Rio Guamá, Rio Mojú; Rio Tocantins, Rio Tapajoz (Snethlage)

2 ♂ 2 ♀, Benevides Carnegie Mus.)
8 ♂ 5 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

Replaced by P. *humboldti* Wagler from the Rio Madeira westward.

380. Pteroglossus viridis viridis (Linnæus)

Type locality: Cayenne

Maracá, Obidos, Rio Jamundá (Snethlage); Obidos (Pinto).

6 ♂, 2 ♀, Obidos (Carnegie Mus.)

The southern limit of this species is apparently the north bank of the Amazon. It is replaced by *didymus* Sclater in far upper Amazonia. This race and *humboldti* bridge the gap between *viridis* and *inscriptus*.

381. Selenidera maculirostris gouldi (Natterer)

Type locality: Pará

Pará (Layard, Natterer, Stone, Wallace); Igarape-Assu and Ipitinga (Hellmayr); Rio Capim (Goeldi); Providencia, Rio Mojú (Snethlage).

1 ♂ 1 ♀, Pará, Val-de-Caes and Bosque
1 ♀, Rio Acará, Acará

Birds from the Rio Tocantins (Snethlage) may be this form or the next.

382. Selenidera maculirostris hellmayri Griscom & Greenway, 1937

Type locality: Rio Tapajoz, Boim
Santarem, Itaituba (Pinto)
1 ♂ 1 ♀, Rio Tapajoz, Boim and Tauary.
3 ♀, Santarem (Carnegie Mus.)
2 ♂ 2 ♀, Rio Tapajoz, left bank (do.)

383. Selenidera culik (Wagler)

Type locality: Cayenne
Obidos (Hellmayr), Obidos (Pinto)
6 ♂ 2 ♀, Obidos (Carnegie Mus.)

Family PICIDAE

384. Colaptes campestris chrysosternus (Swainson)

Type locality: the Sertao of Bahia
Monte Alegre (Snethlage)

Birds from this isolated colony on the north bank of the Amazon should be compared with typical material from much further south.

385. Piculus chrysochloros paraensis (Snethlage)

Type locality: Pará
Murutucu (Hagmann, Snethlage); Pará (Snethlage)
1 ♀, Rio Tapajoz, Caxiricatuba
1 ♀, Santarem (Carnegie Mus.)

Recorded west to the right bank of the Rio Tapajoz, but very few specimens exist. The closely allied race *capistratus* (Malherbe) has been found at Manaos, and should be sought on the north bank of the Amazon in our area.

386. Piculus chrysochloros hypochryseus Todd, 1937

Type locality: Arima, Rio Purus, Brazil
2 ♂ 1 ♀, Rio Tapajoz, Villa Braga and Miriti tuba (Carnegie Mus.)

387. Piculus flavigula flavigula (Boddaert)

Type Locality: Cayenne
Rio Jary, Rio Jamundá (Snethlage); Obidos (Hellmayr)
3 ♂, Obidos (Carnegie Mus.)

388. Piculus flavigula magnus (Cherrie and Reichenberger)

Type locality: Monte Christo, Matto Grosso
Numerous records throughout the area south of the Amazon by all collectors; absent on Mexiana and Marajo Islands
1 ♀, Pará, Bosque
1 ♂ 2 ♀, Rio Tapajoz, Tauary and Caxiricatuba
1 ♂, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)
2 ♂, 1 ♀, Rio Tapajoz, Villa Braga (do.)

A puzzling series of intermediates, which we have compared with a good series of true *flavigula* from Guiana and the type, and two other recorded specimens of *magnus* in the American Museum of Natural History. One Pará bird is inseparable from true *flavigula*. The Rio Tapajoz birds agree perfectly in longer wing with *magnus*, but have slightly smaller and weaker bills. All birds seen from south of the Amazon differ from true *flavigula* in having the olive green of the underparts a slightly paler shade.

389. Chrysoptilus melanochloros mariae Hargitt

Type locality: Chamicuros, east Peru in error; actually Marajo Island
Marajo Island (Hagmann and Snethlage)

This race of the very variable *malanochloros* of eastern and southern Brazil is otherwise known only from a small island off the coast of Maranhao.

390. Chrysoptilus punctigula punctigula (Boddaert)

Type locality: Cayenne
Amapá, Monte Alegre, Paituna, Rio Jamundá (Snethlage); Lago Cuipeua (Pinto)
3 ♂ 2 ♀, Obidos (Carnegie Mus.)

The Obidos birds agree perfectly with a fine series from Cayenne and Surinam.

391. Chrysoptilus punctigula pallidior
Griscom & Greenway, 1937

Type locality: Amazon River, Lago Grande
Santarem (Chapman and Riker, Pinto); Lago Grande (Pinto)
1 ♂ 5 ♀, Lago Grande
7 ♂ 7 ♀, Santarem (Carnegie Mus.)

The few records of this species from our area have always been called *guttatus* (Spix), a subspecies which is still credited with too extensive a range for so variable a bird. Hellmayr has shown that Spix's type agrees with a Natterer specimen from Manaos. This subspecies, unknown to us from topotypes, differs from *punctigula* only in those respects in which *pallidior* and *punctigula* are alike.

392. Leuconerpes candidus (Otto)

Type locality: Cayenne *errore*

Mexiana Island (Hagmann, Snethlage); Marajo Island, Monte Alegre, Paituna (Snethlage); Lago Cuipeua (Pinto)

3 ♂ 4 ♀, near Obidos
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
3 ♂ 3 ♀, Santarem (do.)

393. Tripsurus cruentatus cruentatus (Boddaert)

Type locality: Cayenne

Pará region (numerous records); Rio Tocantins (Pinto); Santarem and Rio Tapajoz (all collectors)

1 ♂ 1 ♀, Rio Tapajoz, Tauary
3 ♂, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)

394. Tripsurus cruentatus extensus Todd, 1937

Type locality: Arima, Rio Purus

3 ♂ 2 ♀, Rio Tapajoz, left bank, Villa Braga, Apaçy, Miriti tuba, (Carnegie Mus.)

Birds from the Rio Tapajoz are intermediates between these two subspecies, but those from the left bank are on the whole nearer *extensus*.

395. Tripsurus rubrifrons (Spix)

Type locality: Pará

Pará region, numerous records (all collectors)

1 ♂, Benevides (Carnegie Mus.)

Mr. Todd (1937, pp. 250–251) has recently commented on the curious relationships between *cruentatus* and *rubrifrons*. The former of these supposed species is common and wide ranging; the latter is

restricted to the Guianas and the Pará region. In the Guianas, *rubrifrons* is definitely commoner than *cruentatus*. As regards external differences, *rubrifrons* might be described as a *cruentatus* which has lost the white postocular stripe and the yellow nuchal collar. Now the collections in the Carnegie Museum show clearly various types of intermediates. Some have no nuchal collar, others have no superciliary or it is incomplete. We are obviously dealing with hybrids between two species, or *rubrifrons* is a color phase of *cruentatus*, localized in a portion only of the latter's range. Mr. Todd inclines to the hybrid theory largely on the ground that the characters of *cruentatus* are so constant over the greater part of its extensive range. Our own idea is that *rubrifrons* is an imaginary species, a mere color phase of *cruentatus*, which is losing its white postocular and yellow nuchal collar in the northeastern portion of its range. The chief arguments against the hybrid theory are that there is no region where only *rubrifrons* occurs, and its characters are purely negative.

396. Veniliornis passerinus passerinus (Linnæus)

Type locality: Cayenne
Cussary, Amapá, Monte Alegre, Rio Maecuru, Obidos (Snethlage)
1 ♂, Obidos (Carnegie Mus.)

397. Veniliornis passerinus subspecies

Mexiana and Marajo Islands (Snethlage, Hellmayr)
1 ♀, Santarem
5 ♂ 2 ♀, do. (Carnegie Mus.)

Apparently no adequate series from the south bank of the Amazon has ever been reported on. Our birds are quite different from a great series from Cayenne in the Carnegie Museum in being a more golden brown, both above and below. They appear to be intermediate between *passerinus* and *taenionotus* (Reichenbach) in size and color. Our material of this latter form and *transfluvialis* Hellmayr is inadequate; both occur in Piauhy and the latter in Maranhao, very close to our area, where Marajo Island birds might belong. Snethlage records *taenionotus* and *passerinus* as distinct species and occurring together in the same place. The characters formerly used to separate these alleged "species" were, however, chiefly matters of individual variation.

398. Veniliornis affinis cassini (Malherbe)

Type locality: Cayenne, by subsequent designation
Rio Jary, Monte Alegre, Obidos, Rio Jamundá (Snethlage)
2 ♂ 4 ♀, Obidos (Carnegie Mus.)

399. Veniliornis affinis ruficeps (Spix)

Type locality: Amazon River
Pará (Layard, Natterer, Stone); Peixe-Boi and Ipitinga (Hellmayr); Rio Muraiteua (Stone); Rio Capim (Goeldi); Santarem (Chapman and Riker, Hellmayr); Marajo Island, Rio Tocantins, Rio Iriri and Rio Tapajoz (Snethlage)
13 ♂ 7 ♀, Rio Tapajoz, various localities east bank
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
7 ♂ 6 ♀, Santarem (do.)
3 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

Typical *affinis* occurs in southern and eastern Brazil. On the Rio Madeira westward, we encounter *haematostigma* (Malherbe), which is a composite of several subspecies.

400. Celeus flavescens ochraceus (Spix)

Type locality: Amazon River
Santarem (Chapman and Riker); Cussary, Monte Alegre (Snethlage); Obidos (Hellmayr); Marajo Island (Pinto)
2 ♂ 1 ♀, near Obidos
5 ♂ 1 ♀, Rio Tapajoz, various localities
3 ♂ 3 ♀, Obidos (Carnegie Mus.)
8 ♂ 5 ♀, Santarem (do.)

401. Celeus elegans elegans (P.L.S. Müller)

Type locality: Cayenne
Obidos (Hellmayr); Cunany, Rio Jamundá (Snethlage); Obidos (Pinto).
2 ♂ 5 ♀, Obidos (Carnegie Mus.)

402. Celeus jumana jumana (Spix)

Type locality: in sylvis Amazonum

Pará (Layard, Wallace, Stone, Natterer); Muria (Natterer); Rio Capim (Goeldi); Utinga, Ipitinga, Igarape-assu (Hellmayr); S. Antonio do Prata, Sta. Isabel, Rio Tocantins, Rio Tapajoz (Snethlage); Santarem (Hellmayr)

3 ♀, Pará, Val-de-Caes
2 ♂ 2 ♀, Rio Tapajoz, various localities
1 ♂, Benevides (Carnegie Mus.)
5 ♂ 2 ♀, Santarem (do.)
3 ♂ 3 ♀, Rio Tapajoz, Apaçy (do.)

403. Celeus undatus multifasciatus (Malherbe)

Type locality: Brazil

Pará (Natterer, Stone); Ipitinga (Hellmayr); Ananindeua, Maguary, S. Antonio do Prata, Rio Tocantins (Snethlage)

2 ♂ 2 ♀, Benevides (Carnegie Mus.)

404. Celeus grammicus subcervinus Todd, 1937

Type locality: Rio Tapajoz, Villa Braga

1 ♂ 1 ♀, Santarem (Carnegie Mus.)
2 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

This species is recorded from Cussary (Snethlage), but there is no telling what subspecies it may prove to be; possibly typical *grammicus*.

405. Crocomorphus flavus flavus (P.L.S. Müller)

Type locality: Cayenne

Amapá, Rio Jamundá, Faro (Snethlage)

406. Crocomorphus flavus inornatus Cherrie

Type locality: Santarem, Rio Tapajoz

Pará (Natterer, Stone); numerous records near city (Snethlage); Marajo Island (Snethlage); Cussary (Snethlage); Santarem (Chapman and Riker)

1 ♀, Pará, Val-de-Caes
3 ♂ 4 ♀, Rio Tapajoz, various localities.
2 ♂, Benevides (Carnegie Mus.)
4 ♂ 5 ♀, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

Our series shows that this race is phenomenally variable. Six specimens only have no rufous on the outer webs of the secondaries and wing-coverts. The balance have more or less, and are indistinguishable from Cayenne topotypes. Two only are devoid of the extensive white spotting on the upper wing. Several are inseparable from true *flavus* in this respect, and all the remainder have some.

407. Cerchneipicus torquatus (Boddaert)

Type locality: Cayenne
1 ♂, Obidos (Carnegie Mus.)

408. Cerchneipicus tinnunculus angustus

Griscom & Greenway, 1937

Type locality: Rio Tapajoz, Caxiricatuba
Rio Mojú, Cussary, Rio Tapajoz, Boim (Snethlage)
1 ♂, Rio Tapajoz, Caxiricatuba (M.C.Z.)
3 ♂ 1 ♀, Santarem (Carnegie Mus.)

409. Scapaneus rubricollis rubricollis (Boddaert)

Type locality: Cayenne
1 ♂ 2 ♀, Obidos (Carnegie Mus.)

410. Scapaneus rubricollis trachelopyrus (Malherbe)

Type locality: Peru
Numerous records throughout our area on the south side of the Amazon.
2 ♀, Pará, Val-de-Caes
10 ♂ 1 ♀, Rio Tapajoz, various localities
1 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)

In default of topotypical Peruvian material, we can only follow Hellmayr in referring our series here, on the ground that the outer webs of the primaries are extensively rufous. Brazilian birds should prove separable, as they are apparently smaller than the two Peruvian birds Hellmayr measured.

411. Scapaneus melanoleucos melanoleucos (Gmelin)

Type locality: Surinam

Pará (Natterer); Mexiana Island (Hagmann); Marajo Island and north bank of Amazon (Snethlage); Santarem (Chapman and Riker); Caviana Island (Brodkorb)

2 ♀, north bank of Amazon near Obidos
2 ♂, Rio Tapajoz, Santarem and Pinhy
1 ♂, Santarem (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

412. Ceophloeus lineatus lineatus (Linnæus)

Type locality: Cayenne

Recorded by all collectors throughout the area

1 ♀, Pará, Val-de-Caes
1 ♂ 3 ♀, Rio Tapajoz, east bank
1 ♂, Obidos (Carnegie Mus.)

413. Picumnus cirrhatus macconnelli Sharpe

Type locality: British Guiana

Marajo Island (Hellmayr); Santarem (Chapman and Riker); Arumanduba, Monte Alegre, Rio Tocantins (Snethlage)

3 ♂ 5 ♀, north bank of Amazon River near Obidos.
1 ♂, Rio Tapajoz, Santarem
1 ♀, Obidos (Carnegie Mus.)
13 ♂ 16 ♀, Santarem (do.)

These birds are very different from true *cirrhatus*, of which we have an excellent series, in just the respects Hellmayr says characterize *macconnelli*, which he records from Pará (cf. Novit. Zool., 1913, p. 349). P. *amazonicus* Snethlage 1906 (*nec buffoni amazonicus* Snethlage, 1914) is a synonym.

414. Picumnus varzeæ Snethlage

Type locality: Obidos

Obidos and Rio Jamunda, Faro (Snethlage)

24 ♂ 27 ♀, Obidos (Carnegie Mus.)

A very distinct species, put next to *cirrhatus* by Madame Snethlage. It has nothing to do with this species, but the key and description in the Cat. Aves Amazonicas are so poor that no one would imagine how distinct it is.

415. Picumnus guttifer pallidus Snethlage

Type locality: Quatipuru, northeast of Pará

Only known from the type locality and obviously connecting *guttifer* and *spilogaster*.

416. Picumnus exilis buffoni Lafresnaye

Picumnus buffoni meridionalis Domaniewski: New name for *P. b. amazonicus* Snethlage, 1914, preoccupied by *P. amazonicus* Snethlage, 1906. (cf. Ann. Zoöl. Mus. Polon., **4**, 1925, p. 296).

Rio Jary and Obidos (Snethlage)

2 ♂ 2 ♀, Obidos (Carnegie Mus.)

Inseparable from true *buffoni* of Cayenne, of which we have seen a great series of topotypes.

417. Picumnus aurifrons transfasciatus Hellmayr & Gyldenstolpe

Type locality: Marai, east bank of Rio Tapajoz. (cf. Arkiv Zoöl., **29** B, no. 6, Jan. 1937, p. 1)

Rio Curuá and Rio Tacantins (Snethlage)

16 ♂ 9 ♀, Rio Tapajoz; various localities east bank.
1 ♂, Santarem (Carnegie Mus.)
3 ♂ 1 ♀, Rio Tapajoz. (do.)

In this recent paper, typical *aurifrons* is restricted to the Rio Madeira.

418. Picumnus borbae Pelzeln

Type locality: Borba, Rio Madeira, Brazil

Santarem (Hellmayr); Rio Jamauchim, Rio Tapajoz, Boim, Pinhel, Villa Braga (Snethlage)

7 ♂ 2 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)
3 ♂, (do.), Itaituba (do.)
2 ♂ 2 ♀, (do.), Apaçy (do.)

This species is only known from the localities cited above, and its range is consequently included in that of *aurifrons*. It differs from that species only in that the crown feathers of the male are tipped with red instead of yellow.

In the Carnegie Museum series, all male *aurifrons* have faintly barred backs, and all male *borbae* have uniform olive backs. We consequently refer females with barred backs to *aurifrons*, and those with

immaculate backs to *borbae*. We are reinforced in this theory by the fact that two obviously immature birds, one of which is unquestionably *borbae*, because the red crown, spots are coming in, have the backs uniform.

Family DENDROCOLAPTIDAE

419. Dendrocolaptes certhia certhia (Boddaert)

Type locality: Cayenne

Rio Jary, Obidos (Snethlage); Rio Jamundá (Snethlage and Zimmer)

7 ♂ 4 ♀, Obidos (Carnegie Museum)

420. Dendrocolaptes certhia concolor Pelzeln

Type locality: Villa Bella de Matto Grosso; Borba, Rio Madeira (Hellmayr, by subsequent designation)

Various localities, west bank of Rio Tapajoz (Snethlage, Zimmer).

1 ♂ 1 ?, Rio Tapajoz, east bank (approaching *medius*)

5 ♂ 3 ♀, Rio Tapajoz, west bank (Carnegie Mus.)

421. Dendrocolaptes certhia medius Todd

Type locality: Benevides, Pará

Pará (Wallace, Stone); Igarape-Assu, S. Antonio do Prata, Peixe-Boi (Hellmayr); Magoary (Steere); Providencia, Apehú, Rio Guamá (Snethlage)

1 ♂, Rio Acará, Acará

1 ♂ 1 ♀, Benevides (Carnegie Mus.)

6 ♂ 6 ♀, Santarem (do.)

1 ♂ , Rio Tapajoz, right bank (do.)

This species is well known from every part of the south bank of the Amazon in our area. Zimmer has written at length of the remarkably inconsistent manner in which intergradation takes place; (cf. Amer. Mus. Novit., no 753, p. 2). Birds from the east bank of the Tapajoz to the Rio Tocantins are three different types. Some as far east as the Tocantins are *concolor;* a very few birds from the Tocantins are *medius;* all others are variously intermediate.

The series in the Carnegie Museum supports Zimmer's comments on the variability of this species. On the other hand, it does not support Hellmayr's reduction to synonymy of his own *ridgwayi* from Santarem. Birds from Pará to the Rio Acará are homogeneous, and are less different from true *certhia* than is the Santarem series from

medius. *Concolor* differs from a Santarem series in averaging browner and more uniform below. Three Santarem birds are the *concolor* type, but all the others are easily separable from *concolor*, and strikingly distinct from the Pará *medius*. On the basis of our material, therefore, *ridgwayi* should be recognized.

There are, of course, numerous other races of this variable species, which has a wide distribution northward and westward.

422. Dendrocolaptes hoffmansi Hellmayr

Type locality: Calamá, Rio Madeira

Villa Braga, left bank of Rio Tapajoz (Snethlage), recorded in error as "*concolor ridgwayi*")

3 ♂ 2 ♀, Rio Tapajoz, Villa Braga and Apaçy (Carnegie Mus.)

Only known from the localities listed above.

423. Dendrocolaptes transfasciatus Todd

Type locality: Miriti tuba, Rio Tapajoz

2 ♂, Santarem

2 ♂, Santarem (Carnegie Museum)

1 ♂, Miriti tuba (do.)

Apparently a very rare bird, known from the three original specimens, the two here listed, and one from Santarem in the Museu Paulista (Pinto).

These two species presumably represent the *picumnus* group on the south bank of the Lower Amazon. We have here a fine illustration of the disadvantages of the trinomial system. On the "Formenkreis" theory, these two birds could be reduced to subspecies of *picumnus*. The facts are however, that geographically, they are isolated from any other race of that species, nor are intermediate specimens known. Treated as races, they are obviously not homologous with the subspecific variation just discussed in the species *certhia*. Treated as species, they are not homologous with the specific characters of *certhia* as contrasted with *picumnus* or *platyrostris*. The limits of our nomenclature cannot bring out the exact facts.

424. Dendrocolaptes picumnus picumnus Lichtenstein

Type locality: Cayenne

Obidos, Rio Jamundá (Snethlage and Zimmer)

16 ♂ 7 ♀, Obidos (Carnegie Mus.)

425. Dendrexetastes rufigula rufigula (Lesson)

Type locality: Cayenne
Obidos (Hellmayr)
1 ♂, Obidos (Carnegie Mus.)

426. Dendrexetastes rufigula paraensis Lorenz

Type locality: Marco de Lagoa, Pará

An exceedingly rare genus and species. The type of the present race is still unique. On the right bank of the Rio Madeira, we find *moniliger* Zimmer. The bird will almost certainly be found in the intermediate area.

427. Hylexetastes perrotii perrotii (Lafresnaye)

Type locality: Cayenne
Obidos and Rio Jamundá (Snethlage, Zimmer, Pinto)
5 ♂ 6 ♀, Obidos (Carnegie Museum)

428. Hylexetastes perrotii uniformis Hellmayr

Type locality: Calamá, Rio Madeira
Rio Tapajoz: right bank, Caxiricatuba; left bank, Igarape-Brabo, Igarape Amorin; Rio Jamauchim (all Zimmer)
1 ♂, Rio Tapajoz, Caxiricatuba
2 ♂ 2 ♀, Santarem (Carnegie Mus.)
2 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

429. Xiphocolaptes orenocensis berlepschi Snethlage

Type locality: Cachoeira, Rio Purus
Rio Tapajoz, Apaçy; Colonia de Mojuy, Santarem (Hellmayr, in Carnegie Museum)
2 ♂, Santarem (Carnegie Mus.)
1 ♀, Rio Tapajoz, Apaçy (do.)

Hellmayr and Zimmer differ as to whether *orenocensis* is specifically distinct from *promeropirhynchus* or not.

The two birds from Santarem appear to be a distinct subspecies from true *berlepschi*, of which we have 3 from the Rio Purus, and 2 from Tonantins, Rio Solimoës. We note, however, that one of the latter is inseparable from the Santarem birds, so that better series are obviously needed. A specimen from Manacapuru, north bank of the Solimoës, is apparently *ignotus* Ridgway.

430. Dendroplex picus picus (Gmelin)

Type locality: Cayenne

Recorded abundantly by all authors from every part of our area, including Marajo Island.

1 ♂ 1 ♀, north bank of Amazon near Obidos
11 ♂ 11 ♀, Rio Tapajoz; various localities
1 ♂, Obidos (Carnegie Mus.)
10 ♂ 2 ♀, Santarem (do.)
3 ♂ 1 ♀, Rio Tapajoz, left bank (do.)

The three birds from near Obidos are more rufescent below than the Rio Tapajoz and a great series from Cayenne and Surinam. They thus agree with Hellmayr's comment on birds from the Rio Branco in approaching *kienerii*. Those from Villa Braga have the larger size of *kienerii*, but are not more rufescent.

431. Dendroplex necopinus Zimmer

Type locality: Muirapinina, Rio Negro

Rio Jamundá, Faro and Villa Bella Imperatriz (Zimmer)

We have nothing but admiration for the keenness displayed by Mr. Zimmer in picking out the anomalous birds described as *necopinus* from his fine series of *picus*. We have 30 specimens before us, representing *kienerii* from both banks of the Rio Solimoës (Manacapuru, Caviana, Sao Paulo de Olivença, islands in the river near Manacapuru), and the Rio Purus (Arima, Nova Olinda, Hyutanahan). Two birds from the islands in the Solimoes stand out from this series, and display *every one* of the characters of color and proportionate size ascribed to *necopinus*. Moreover, one is obviously adult and one is immature, thus endorsing Mr. Zimmer's contention that the characters of *necopinus* cannot be ascribed to some stage of immaturity of *picus*. They come, however, from so near the type locality of *kienerii*, that the application of the name becomes, perhaps, doubtful. A third specimen from the same locality is apparently an intermediate. The bill and color characters are those of *kienerii*, but it has the proportionately long tail of *necopinus*. A male adult from Villa Braga has the ovate streaking of *necopinus* rather than the squamate effect of *picus;* it is olivaceous on the mantle rather than the rufescence of *picus*. It has the proportionately shorter tail of *picus*. The bill is that of *picus*. In the longer wing-tip, and brown rather than rufous wing-

coverts, it resembles *necopinus*. It will be apparent, therefore, that the shorter, slender bill of *necopinus* is its best character.

We heartily agree with Mr. Zimmer in "seriously questioning" the distinctness of the genus Dendroplex.

432. Xiphorhynchus guttatus guttatoides (Lafresnaye)

Type locality: Rio Marañon, Peru
Villa Bella Imperatriz (Zimmer)

433. Xiphorphynchus guttatus eytoni (Sclater)

Type locality: Rio Capim, Pará
Innumerable records throughout the balance of our area from Marajo Island (Snethlage) west to the Rio Madeira.

2 ♀, Rio Acará, Acará
10 ♂ 5 ♀, Rio Tapajoz; various localities right bank.
7 ♂ 3 ♀, Benevides (Carnegie Mus.)
14 ♂ 5 ♀, Santarem (do.)
3 ♂ , Rio Tapajoz, both banks (do.)

We are by no means convinced that there is not another recognizable subspecies along the south bank of the Amazon. Our Tapajoz series differs strikingly from the Acará birds in being more richly ochraceous below, and in having the feathers of the back with much broader, light centers, giving a less streaked, more guttate effect. While we defer to Zimmer's critique of the remarkably variable nature of this series, we note that he lists no topotypes of *eytoni* in his enormous series, and Hellmayr, who had a good series of *eytoni*, lists only two specimens outside the Pará region.

434. Xiphorhynchus guttatus polystictus (Salvin and Godman)

Type locality: Bartica Grove, British Guiana
Obidos (Hellmayr); Faro (Zimmer and Snethlage); Pataua (Pinto)
7 ♂ 3 ♀, Obidos (Carnegie Mus.)

Zimmer has shown (Amer. Mus. Nov., no. 756, 1934) that this little known "species" is merely an earlier name for the well known *sororius* (Berlepsch and Hartert). It is interesting to see how the various races meet and intergrade along the extreme western limits of our area.

435. Xiphorphynchus ocellatus ocellatus (Spix)

Type locality: corrected to Rio Madeira
Left bank of the Rio Tapajoz (Snethlage); Villa Bella Imperatriz, Faro, Rio Xingú and Rio Tocantins (Zimmer)
12 ♂ 5 ♀, Rio Tapajoz, Apaçy and Villa Braga (Carnegie Mus.)

436. Xiphorhynchus pardalotus (Vieillot)

Type locality: Cayenne
Rio Jary, Obidos, Rio Jamundá (Snethlage); also right bank of Rio Tapajoz (Zimmer)
9 ♂ 3 ♀, Obidos (Carnegie Mus.)

This species occurs with *ocellatus* on the north bank of the Amazon, and occurs on the south bank only where *ocellatus* is apparently lacking.

437. Xiphorhynchus spixii spixii (Lesson)

Type locality: Pará
Abundant from Pará to the right bank of the Tapajoz
2 ♂ 2 ♀, Pará, Bosque
4 ♂ 4 ♀, Rio Tapajoz, right bank
8 ♂ 4 ♀, Benevides (Carnegie Mus.)
5 ♂ 3 ♀, Santarem (do.)
9 ♂ 3 ♀, Rio Tapajoz, right bank (do.)

This great series shows that *fraterculus* Ridgway is untenable.

438. Xiphorhynchus spixii elegans (Pelzeln)

Type locality: Engenho do Gama, Matto Grosso
Rio Tapajoz, left bank, Villa Braga (Snethlage) and Itaituba (Hellmayr).
7 ♂ 4 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

A bird of very limited distribution; otherwise known only along the Rio Madeira.

439. Xiphorhynchus obsoletus obsoletus (Lichtenstein)

Type locality: "province of Pará"
Recorded from the north bank (Snethlage), and the south bank from the Rio Tocantins westward (Chapman and Riker, Snethlage, Zimmer)
1 ♂, Obidos
3 ♂ 1 ♀, Pará, Val-de-Caes
5 ♂ 3 ♀, Rio Tapajoz; various localities.
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
11 ♂ 3 ♀, Santarem (do.)
4 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

Apparently never definitely reported previously near Pará. Our specimens agree with three from Obidos in being a warmer, more rufescent brown than the Tapajoz series. Zimmer has shown that certain specimens from the north bank approach *notatus* (Eyton).

440. Lepidocolaptes albolineatus albolineatus (Lafresnaye)

Type locality: Cayenne
Rio Jary, Obidos, Rio Jamundá (Snethlage)
9 ♂ 4 ♀, Obidos (Carnegie Mus.)

This is the bird better known as *puncticeps* (Sclater and Salvin).

441. Lepidocolaptes albolineatus layardi (Sclater)

Type locality: Pará
Pará (Layard, Snethlage, Stone, Zimmer); Peixe-Boi (Hellmayr); Rio Guamá (Snethlage); Rio Tocantins (Snethlage, Zimmer); Santarem (Chapman and Riker), Rio Tapajoz, right bank, (Zimmer)
1 ♂, Rio Tapajoz, Caxiricatuba
2 ♂ 3 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)

442. Lepidocolaptes albolineatus madeirae (Chapman)

Type locality: Porto Velho, Rio Maderia
Rio Tapajoz, left bank (Snethlage, Hellmayr, Zimmer)
1 ♂, Rio Tapajoz, Villa Braga (Carnegie Mus.)

Hellmayr and Zimmer disagree on the line of demarcation between these two races, the former referring specimens from the right bank of the Tapajoz to *madeirae*. Hellmayr also regards both these birds as races of *fuscicapillus*, which he regards as specifically distinct.

443. Lepidocolaptes angustirostris coronatus (Lesson)

Type locality: Piauhy
Marajo Island (Hellmayr); Monte Alegre (Snethlage); Santarem (Allen; Pinto)
1 ♂ 2 ♀, Santarem
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

This species is more southern, and is primarily characteristic of campo country. There is only one female on record from the north bank of the Amazon. A series should be carefully compared.

444. Campylorhamphus trochilirostris snethlageæ

Zimmer, 1934

Type locality: Serra de Parintins, Villa Bella Imperatriz. Also recorded from mouth of Rio Andira and Rio Jamundá, Faro (Zimmer); Faro and Monte Alegre (Snethlage)

445. Campylorhamphus procurvoides procurvoides (Lefresnaye)

Type locality: Cayenne
Rio Jary, Rio Jamundá (Snethlage); Faro (Zimmer)
1 ♂, Obidos (Carnegie Mus).

446. Campylorhamphus procurvoides probatus Zimmer. 1934

Type locality: Igarapé Auara, Rio Madeira
Villa Bella Imperatriz, left bank of Rio Tapajoz (Zimmer) and also Snethlage for the latter locality
4 ♂ 3 ♀, Rio Tapajoz, Itaituba, Villa Braga, Apaçy (Carnegie Mus.)

447. Campylorhamphus procurvoides multostriatus

(Snethlage)

Type locality: Arumatheua, Rio Tocantins
Also east bank of Rio Tapajoz and the Rio Xingú (Zimmer); Aveiro (Pinto)
2 ♂ 2 ♀, Rio Tapajoz, Caxiricatuba (August, 1932) and Pinhy (May and June, 1933)
7 ♂ 2 ♀, Santarem (Carnegie Mus.)
2 ♂ 2 ♀, Rio Tapajoz, Miriti tuba (do.)

Zimmer's careful monograph of this group (Amer. Mus. Novit., no. 728, 1934) has been followed here. Its most important departure from Hellmayr's treatment is the discovery of the race *probatus*, connecting the little known *multostriatus* Snethlage with the *procurvoides* group.

448. Nasica longirostris longirostris (Vieillot)

Type locality: Obidos, by subsequent designation
Obidos (Hellmayr); Maracá, Monte Alegre, Rio Maecuru, Rio Jamundá (Snethlage); Marajo Island (Brodkorb)
2 ♂ 5 ♀, Boca do Igarapé-Piaba, near Obidos
1 ♀, Obidos (Carnegie Mus.)

449. Nasica longirostris australis Griscom and Greenway, 1937

Type locality: Santarem, Brazil

Santarem (Chapman and Riker, Hellmayr); Rio Tocantins and Rio Tapajoz (Snethlage); Pataua and Santarem (Pinto)

3 ♂ 2 ♀, 1 imm. ?, Rio Tapajoz, Santarem and Caxiricatuba.
1 ♀, Rio Tapajoz, Apaçy, (Carnegie Mus.)
5 ♂ 5 ♀, Santarem (do.)

The last word has yet to be written on subspecific variation in this Woodhewer. Our description of *australis* was based on the assumption that birds from the south bank of the Amazon were separable from those of the north bank, and the material later examined in the Carnegie Museum confirmed it. Mr. Zimmer, however, assures us that a larger series in the American Museum does not bear out the characters alleged.

However this may be, there are unquestionably two subspecies. Nearly a century ago Lesson described *albicollis* from French Guiana, but even Hellmayr never saw a specimen from that country. Five specimens from French Guiana in the Carnegie Museum are subspecifically distinct from *australis* at a mere glance. It now turns out most unfortunate that we should have restricted typical *longirostris* to Obidos on the north bank of the Amazon. The facts are that this population is intermediate as usual. We do not for a moment favor the recognition of three subspecies. The material in Cambridge, New York, and Pittsburgh should be combined to determine whether *australis* is a synonym of *longirostris,* or whether *albicollis* is a synonym of *longirostris.* Nine times out of ten in birds having a similar range, the best "break" is the Amazon River.

450. Glyphorhynchus spirurus spirurus (Veillot)

Type locality: Cayenne

Amapá and Rio Jamundá, Faro (Snethlage); Faro (Zimmer); Obidos (Hellmayr)

3 ♂, Obidos (Carnegie Mus.)

451. Glyphorhynchus spirurus inornatus Zimmer, 1934

Type locality: Villa Bella Imperatriz

Left bank of Rio Tapajoz (Zimmer)

2 ♂ 1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

This recently described form ranges west to the Rio Madeira.

452. Glyphorhynchus spirurus cuneatus (Lichtenstein)

Type locality: Bahia, Brazil
Abundantly recorded around Pará (all collectors); Rio Tocantins, Rio Xingú and Rio Tapajoz, east bank (Snethlage and Zimmer)
7 ♂ 6 ♀ 1 ? , vicinity of Pará
2 ♂ 1 ♀, Rio Acará, Acará
1 ♀, Rio Tapajoz, Pataua
5 ♂ 2 ♀, Benevides (Carnegie Mus.)
6 ♂ 1 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, right bank (do.)

453. Sittasomus griseicapillus amazonus Lafresnaye

Type locality: Peruvian Amazons
Left bank of Rio Tapajoz (Snethlage and Zimmer); Villa Bella Imperatriz and Rio Xingú (Zimmer); Rio Tocantins (Snethlage)?
11 ♂ 4 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

454. Sittasomus griseicapillus axillaris Zimmer, 1934

Type locality: near Faro, Rio Jamundá, Brazil
Also right bank of Rio Tapajoz (Zimmer)
3 ♂ 1 ♀, Rio Tapajoz, Pinhy and Caxiricatuba
6 ♂ 1 ♀, Santarem (Carnegie Mus.)
2 ♂, Rio Tapajoz, Miriti tuba (do.)
2 ♂ 2 ♀, Obidos (do.)

The species is recorded from Obidos by Hellmayr. In view of the curious distribution of the races we cannot be absolutely certain that this record belongs here. We cannot distinguish them locally.

455. Deconychura longicauda longicauda (Pelzeln)

Type locality: Manaos, Brazil
Rio Jamundá, Faro (Zimmer); Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Obidos (Carnegie Mus.)

456. Deconychura longicauda pallida Zimmer, 1934

Type locality: Rio Purus, Brazil
Villa Bella Imperatriz, Rio Tapajoz, left bank; Rio Iriri and Rio Xingú (Zimmer); Rio Iriri (Snethlage); Peixe-Boi (Hellmayr); Providencia (Snethlage); Benevides (Zimmer)
1 ♂, Rio Tapajoz, Pataua
2 ♂, Benevides (Carnegie Mus.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)
2 ♂, (do.), Villa Braga (do.)

457. Deconychura stictolaema stictolaema (Pelzeln)

Type locality: Borba, Rio Madeira
Villa Bella Imperatriz and Rio Tocantins (Zimmer)
1 ♀, Rio Tapajoz, Pataua
1 ♂, Santarem (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)

458. Deconychura stictolaema clarior Zimmer, 1929

Type locality: Pied Saut, Oyapok, French Guiana
Rio Jamundá, Faro (Zimmer); Igarapé Anibá (Pinto)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)

459. Dendrocincla merula merula (Lichtenstein)

Type locality: Cayenne
Rio Jamundá, Faro (Zimmer)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)

460. Dendrocincla merula badia Zimmer, 1934

Type locality: Pedral, Rio Tocantins
Igarapé-Assu, Peixe-Boi (Hellmayr); Rio Guamá (Snethlage); Rio Tocantins, right bank (Zimmer)
2 ♀, Rio Acará, Acará

461. Dendrocincla merula castanoptera Ridgway

Type locality: Diamantina, Pará, Brazil
Santarem (Chapman and Riker); Rio Tapajoz, right bank (Zimmer)
8 ♂ 5 ♀, Rio Tapajoz, various localities, right bank
7 ♂ 3 ♀, Santarem (Carnegie Mus.)
5 ♂ 2 ♀, Rio Tapajoz, Miriti tuba (do.)

This race presumably ranges eastward to the left bank of the Rio Tocantins.

462. Dendrocincla merula olivascens Zimmer, 1934

Type locality: Villa Bella Imperatriz, Amazon River left bank of the Rio Tapajoz (Snethlage and Zimmer)

1 ♂ 4 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

463. Dendrocincla fuliginosa fuliginosa (Vieillot)

Type locality: Cayenne

Obidos and Rio Jamundá (Snethlage); Faro (Zimmer)

9 ♂ 3 ♀, Obidos (Carnegie Mus.)

464. Dendrocincla fuliginosa rufo-olivacea Ridgway

Type locality: Diamantina, Rio Tapajoz

Vicinity of Pará (numerous collectors); Castanhal (Stone); Rio Acará (Hellmayr); Rio Tocantins (Snethlage and Zimmer); Rio Xingú (Zimmer), Rio Tapajoz, right bank (Zimmer)

2 ♂ 3 ♀, Benevides (Carnegie Mus.)

2 ♂, Santarem (do.)

3 ♂ 4 ♀, Rio Tapajoz, Miriti tuba (do.)

465. Dendrocincla fuliginosa atrirostris (Lafresnaye and D'Orbigny)

Type locality: Guarayos, Bolivia

Left bank of Rio Tapajoz, (Snethlage, Zimmer); Villa Bella Imperatriz (Zimmer)

4 ♂ 2 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

It will be noted that Zimmer's arrangement of the species and races of this genus is radically different from that of Hellmayr. We follow it here, as the material at his command was imcomparably superior.

Family FURNARIIDAE

466. Furnarius minor Pelzeln

Type locality: Rio Madeira

Santarem (Chapman and Riker, Hellmayr); Monte Alegre, Rio Maecuru, Rio Jamundá (Snethlage)

4 ♂ 9 ♀, north bank of Amazon, near Obidos

1 ♂, Obidos (Carnegie Mus.)

2 ♂ 1 ♀, Rio Tapajoz

11 ♂ 12 ♀, Santarem (Carnegie Mus.)

1 ♂ 1 ♀, Rio Tapajoz, right bank (do.)

Two birds from upper Amazonian Ecuador are apparently much buffier below than lower Amazonian series of comparable plumage. This is especially marked on the belly, which is not so extensively white in sharp contrast with the chest.

467. Furnarius figulus pileatus Sclater and Salvin

Type locality: Santarem, Brazil

Santarem (Chapman and Riker); Rio Iriri, Arumanduba, Monte Alegre, Rio Maecuru, Rio Jamundá (Snethlage)

6 ♂ 4 ♀, north bank of the Amazon near Obidos
1 ♀, Obidos (Carnegie Mus.)
1 ♂, Rio Tapajoz, Santarem
7 ♂ 5 ♀, Santarem (Carnegie Mus.)

These two species of *Furnarius* are characteristic of the Amazon River, while *leucopus* has representative races both north and south of the Amazon, but not in the valley itself.

468. Synallaxis albescens subspecies?

Mexiana Island (Hagman); Marajo Island, Arumanduba (Snethlage)

Series from Mexiana and Marajo Islands have yet to be properly compared. Hellmayr's reference of the Mexiana bird to *albigularis* was based on the examination of one immature female. At that time *albigularis* was supposed to range from the Rio Napo, Ecuador throughout the Amazon Valley. The species is primarily found in open "campo" or semi-arid scrub country, and is probably nearly as local in our area, as the few records would indicate. The population considered will probably prove to be one more of the already numerous local subspecies.

469. Synallaxis albescens inaequalis Zimmer, 1935.

Type locality: Villa Bella Imperatriz

1 ♂ 1 ♀, Lago Grande, south bank of the Amazon
1 ♂, Santarem (Carnegie Mus.)

These specimens are provisionally referred to this recently described form, which ranges between the Madeira and Tapajoz rivers, "crossing to the north bank in the same general region."

470. Synallaxis gujanensis gujanensis (Gmelin)

Type locality: Cayenne
Recorded abundantly throughout our area from Marajo Island (Brodkorb) to the left bank of the Rio Tapajoz
1 ♂, near Obidos
2 ♂ 3 ♀, Pará, Val-de-Caes
10 ♂ 9 ♀, Rio Tapajoz, right bank
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
4 ♂ 1 ♀, Benevides (do.)
3 ♂ 4 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, right bank (do.)
3 ♂ 3 ♀, (do.) , left bank (do.)

The typical subspecies ranges south along the coast to Maranhao, and is replaced by *inornata* Pelzeln from the Rio Madeira westward. A certain percentage of birds from the Rio Tapajoz area are minutely hoarier than Pará birds, but there is no necessity for a third subspecies.

471. Synallaxis propinqua Pelzeln

Type locality: Rio Madeira, below mouth of Rio Marcy
Rio Tocantins, Baião (Zimmer)

An interesting range extension of this very distinct upper Amazonian species, which is as yet unknown between the type locality and the Rio Tocantins.

472. Synallaxis rutilans rutilans Temminck

Type locality: Cametá, Rio Tocantins
Rio Tocantins, left bank, Rio Xingú, Rio Iriri, Rio Jamauchim, Rio Tapajoz, right bank (Snethlage); Santarem (Chapman and Riker, Hellmayr); numerous localities in same range (Zimmer)
15 ♂ 11 ♀, 1 ?, Rio Tapajoz, right bank
15 ♂ 4 ♀, Santarem (Carnegie Mus.)
1 ♂ 2 ♀, Rio Tapajoz, right bank (do.)

473. Synallaxis rutilans dissors Zimmer, 1935

Type locality: Manaos, Brazil
Obidos (Snethlage and Zimmer); Faro (Zimmer)
1 ♂ 3 ♀, Obidos (Carnegie Mus.)

474. Synallaxis rutilans amazonica Hellmayr

Type locality: Itaituba, left bank of Rio Tapajoz

Rio Tapajoz, left bank, Boim and Villa Braga (Hellmayr); Villa Bella Imperatriz (Zimmer)

1 ♀ 1 ?, Rio Tapajoz, Pinhel

28 ♂ 15 ♀, (do.), left bank (Carnegie Mus.)

475. Synallaxis rutilans omissa Hartert

Type locality: Pará

Recorded abundantly by all collectors from the vicinity of Pará to the right bank of the Tocantins

2 ♂ 5 ♀, 2 ?, Pará, Val-de-Caes

8 ♂ 4 ♀, Benevides (Carnegie Mus.)

This series raises a very interesting problem. Hartert originally described *omissa* as a distinct species, based on males of the cinereous type, the chestnut reduced to the wings only. Later collections near Pará reported on by Hellmayr yielded females of the chestnut type, which were barely separable from true *rutilans* in minor differences of color, shade and tone. Additional males of the cinereous type proved to have a variable number of feathers on breast and back. Dr. Hellmayr was obviously correct in reducing *omissa* to a race of *rutilans*.

The series before us slightly alters the interpretation of the facts, as it becomes apparent that the sex difference breaks down. We have a pair of adults in the chestnut phase, and the balance of the series consists of cinereous birds of both sexes. A study of this series shows exactly the sexual and age variations to be expected in *Synallaxis*. Some are obviously immature birds in the freckling below, in the shorter, less pointed and less stiff tail feathers. It is also these birds that have the maximum amount of chestnut feathers on the abdomen. It will be apparent, therefore, that some birds are always chestnut and other birds are hatched cinereous. We are dealing, therefore, not with sexual dimorphism, but a color phase.

476. Certhiaxis cinnamomea cinnamomea (Gmelin)

Type locality: Cayenne

Arumanduba, Ereré, (Snethlage); Mexiana Island (Wallace; Hagman); Marajo Island (Müller); Rio Tocantins, Baião (Zimmer), and probably Snethlage also; Caviana Island (Brodkorb)

477. Certhiaxis cinnamomea pallida Zimmer, 1935

Type locality: Igarapé
Cacao Pereira, Rio Negro, Rio Jamundá (Snethlage and Zimmer); Rio Tapajoz (Zimmer); Santarem (Chapman and Riker)
4 ♂, Rio Tapajoz, Pinhel (west bank)
2 ♂, Obidos
2 ♂ 1 ♀, (do.) (Carnegie Mus.)
3 ♂ 1 ♀, Santarem (do.)

478. Certhiaxis mustelina (Sclater)

Type locality: Rio Madeira, Brazil
Santarem (Chapman and Riker); Monte Alegre (Snethlage and Zimmer)
2 ♂ 1 ♀, north bank of Amazon near Obidos
3 ♂ 2 ♀, (do.) (Carnegie Mus.)
1 ♂, Santarem (do.)

479. Cranioleuca vulpina vulpina (Pelzeln)

Type locality: Matto Grosso, Brazil
Rio Tocantins and Rio Tapajoz (Snethlage)
1 ♂ 1 ♀, Rio Tapajoz, Santarem
13 ♂ 5 ♀, Santarem (Carnegie Mus.)
1 ♀, Rio Tapajoz, Miriti tuba (do.)

480. Cranioleuca vulpina alopecias (Pelzeln)

Type locality: Rio Branco, Brazil
Monte Alegre, Rio Maecuru (Snethlage)
3 ♂ 3 ♀, near Obidos
1 ♂ 3 ♀, Obidos (Carnegie Mus.)

481. Cranioleuca müller (Hellmayr)

Type locality: Mexiana Island
Also Monte Alegre, Obidos, Rio Jamundá (Snethlage)
1 ♀, north bank near Obidos
3 ♀, Obidos (Carnegie Mus.)
4 ♂ 2 ♀, Santarem (do.)

482. Cranioleuca gutturata (Lafresnaye and D'Orbigny)

Type locality: Yuracares, Bolivia
Rio Tocantins, Rio Tapajoz (Snethlage)
3 ♂, Rio Tapajóz, Miriti tuba (Carnegie Mus.)

A comparatively little known bird, with a remarkably wide but scattered distribution.

483. Thripophaga fusciceps obidensis Todd

Type locality: islands near Obidos, Brazil
2 ♂ 4 ♀, Obidos (Carnegie Mus.)

Known only from the type series of six specimens in the Carnegie Museum. The genus is so rare that other forms will undoubtedly be discovered in the intervening area. Typical *fusciceps* from Bolivia is reported from southeastern Peru and eastern Ecuador, but these specimens do not agree with the type, according to Hellmayr.

484. Berlepschia rikeri (Ridgway)

Type locality: Diamantina, Santarem, Brazil
Pará (Snethlage); Santarem (Chapman and Riker, Pinto)
1 ♂, Pará, Val-de-Caes
1 ♀, Rio Acará, Acará

485. Hyloctistes subulatus subulatus (Spix)

Type locality: Rio Amazonas
3 ♂ 2 ♀, Rio Tapajoz, west bank, Ville Braga (Carnegie Mus.)

An extension of range eastward from the Rio Madeira.

486. Ancistrops strigilatus cognitus

Griscom and Greenway, 1937

Type locality: Tauary, Rio Tapajoz
Santarem and Rio Tapajoz, both banks (Griscom and Greenway)
1 ♀, Rio Tapajoz, Tauary
2 ♂ 1 ♀, (do.), Miriti tuba (Carnegie Mus.)
2 ♂ 1 ♀, (do.), Villa Braga (do.)
1 ♂, Santarem (do.)

487. Philydor pyrrhodes (Cabanis)

Type locality: coast of British Guiana
Pará (Snethlage); Rio Capim (Goeldi, Stone); Rio Tocantins, Obidos (Snethlage); Santarem (Hellmayr, Pinto); Utinga, Rio Tocantins, Rio Tapajoz (Zimmer)

2 ♂ 2 ♀, Rio Tapajoz, east bank
1 ♀, Rio Acará, Acará
1 ♂, Obidos (Carnegie Mus.)
2 ♂, Santarem (do.)
3 ♂, Rio Tapajoz, both banks (do.)

488. Philydor erythropterus diluvialis

Griscom and Greenway, 1937

Type locality: Caxiricatuba, right bank of Rio Tapajoz, Pará, Brazil.
Rio Tapajoz, both banks (Griscom and Greenway)

1 ♂, Rio Tapajoz, Caxiricatuba
3 ♂ (do.), Villa Braga (Carnegie Mus.)

As mentioned in the original description, this subspecies is very distinct from large series from upper Amazonia (east Ecuador, Rio Solimoës, Rio Purus), but whether these last represent true *erythropterus*, based on "Bogota" collections, is problematical.

489. Philydor ruficaudatus (Lafresnaye and D'Orbigny)

Type locality: Yuracares, Bolivia
S. Antonio do Prata, Rio Guamá, Rio Tocantins, Rio Jary (Snethlage)

1 ?, Rio Tapajoz, Tauary
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂, Rio Tapajoz, Miriti tuba, and Villa Braga (do.)

This widely ranging species has proved to be very constant geographically. Snethlage's records should be critically examined in view of the confusion with the next species which has prevailed in the past. We are quite aware that Zimmer (Am. Mus. Novit., 785, March, 1935,) has published a valuable critique on the relations between *P. ruficaudatus* and *P. erythrocercus*, and that he lists no specimens of *P. ruficaudatus* from our area in Brazil. The specimens we record above are, therefore, a notable range extension, and its occurrence in a region where *P. erythrocercus* is abundant further endorses the concept

of *P. ruficaudatus* as a distinct species. The Carnegie Museum also possesses specimens from the Rio Purus, thus partly filling the great hiatus in this species' range.

490. Philydor erythrocercus erythrocercus (Pelzeln)

Type locality: Manaos, Brazil
Obidos (Snethlage); Faro (Zimmer)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)

491. Philydor erythrocercus lyra Cherrie

Type locality: Rio Roosevelt, Matto Grosso
Pará (Wallace, Pará); Peixe-Boi, Igarapé-Assu, S. Antonio do Prata (Hellmayr); Santarem (Chapman and Riker); Sta. Isabel, Rio Guamá, Rio Moju, Rio Tocantins, Rio Xingû, Rio Curua, Rio Tapajoz, Rio Jamauchim (Snethlage); large series, Pará to Villa Bella Imperatriz (Zimmer)
5 ♂ 3 ♀, Pará, Val-de-Caes
15 ♂ 5 ♀ 1 ?, Rio Tapajoz, various localities, east bank.
32 ♂ 11 ♀, Benevides, Rio Tapajoz, Santarem (Carnegie Mus.)

492. Automolus infuscatus cervicalis (Sclater)

Type locality: Bartica Grove, British Guiana
Rio Jary (Snethlage); Obidos (Hellmayr); Faro (Zimmer)
2 ♂ 2 ♀, Obidos (Carnegie Mus.)

493. Automolus infuscatus paraensis Hartert

Type locality: Benevides, near Pará
Near city of Pará and Rio Acará (numerous records, all collectors); Rio Tocantins, Rio Iriri, Rio Tapajoz, Rio Jamauchim (Snethlage); Rio Tapajoz to Pará (Zimmer)
1 ♂ 1 ♀, Pará, Bosque
9 ♂ 8 ♀ 1 ?, Rio Tapajoz, various localities east bank
5 ♂ 4 ♀, Benevides (Carnegie Mus.)
11 ♂ 5 ♀, Santarem (do.)
2 ♂ 3 ♀, Rio Tapajoz, both banks (do.)

494. Automolus ochrolaemus auricularis Zimmer

Type locality: Caxiricatuba, Rio Tapajoz
Rio Tapajoz (Snethlage and Zimmer); Villa Bella Imperatriz (Zimmer)
3 ♂ 2 ♀, from the type locality.
2 ♂ 1 ♀, Santarem (Carnegie Mus.)
17 ♂ 4 ♀, Rio Tapajoz, both banks (do.)

495. Automolus ochrolaemus turdinus (Pelzeln)

Type locality: Manaos, Brazil
Obidos, Rio Jamundá (Faro) on the north bank (Snethlage and Zimmer)
2 ♂ 1 ♀, Obidos (Carnegie Mus.)

496. Automolus rufipileatus rufipileatus (Pelzeln)

Type locality: Pará
Pará (Natterer); Rio Guamá (Stone); Rio Tocantins, Baião (Snethlage); Rio Tapajoz (in Carnegie Museum, fide Hellmayr)
2 ♂ 1 ♀, Santarem (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Miriti tuba (do.)

A rare and little known species, the typical race reported west to the Rio Purus.

497. Xenops minutus genibarbis Illiger

Type locality: Cametá, Rio Tocantins
Pará (Stone); S. Antonio do Prata (Hellmayr); numerous localities near Pará (Snethlage); Rio Tocantins, Rio Xingú, Rio Jamauchim, Rio Tapajoz (Snethlage); Santarem (Hellmayr); numerous localities, Pará to Villa Bella Imperatriz (Zimmer)
1 ♂, Pará, Bosque
1 ♂ 1 ?, Rio Acará, Acará
12 ♂ 4 ♀, Rio Tapajoz, various localities, east bank
13 ♂ 8 ♀, Benevides, Santarem, Rio Tapajoz, both banks, (Carnegie Mus.)

498. Xenops minutus ruficaudus (Vieillot)

Type locality: Cayenne
Obidos (Snethlage); Faro (Zimmer)
3 ♂ 1 ♀, Obidos (Carnegie Mus.)

499. Xenops tenuirostris tenuirostris Pelzeln

Type locality: Rio Madeira
Rio Tapajoz, Apaçy, Itaituba (Hellmayr); left bank of Rio Tapajoz (Zimmer)
2 ♂ 1 ♀, Rio Tapajoz, Apaçy, Itaituba (Carnegie Mus.)

500. Xenops rutilans purusianus Todd

Type locality: Hyutanahan, Rio Purus, Brazil
Left bank of Rio Tapajoz, Igarapé Amorin (Zimmer)

It is interesting to note that *minutus* is very definitely the dominant species in our area.

501. Sclerurus mexicanus macconnelli Chubb

Type locality: Ituribisci, British Guiana
Rio Capim (Wallace); Peixe-Boi (Hellmayr); Rio Tapajoz (Snethlage and Zimmer)

1 ♀, Pará, Bosque
3 ♂, Rio Tapajoz, east bank
3 ♂, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)
3 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

502. Sclerurus rufigularis rufigularis Pelzeln

Type locality: Borba, Rio Madeira
Pará, Rio Guamá (Stone); S. Antonio do Prata (Hellmayr); various localities near Pará and Rio Tocantins (Snethlage)

1 ♂ 1 ♀, Pará, Bosque
2 ♂ 2 ♀, Benevides (Carnegie Mus.)

503. Sclerurus rufigularis fulvigularis Todd

Type locality: Tamanoir, French Guiana
Obidos (Snethlage)

3 ♀, Obidos (Carnegie Mus.)

504. Sclerurus caudacutus insignis Zimmer, 1934

Type locality: Faro, Rio Jamundá, Brazil

Only known from the type locality.

505. Sclerurus caudacutus pallidus Zimmer, 1934

Type locality: Villa Bella Imperatriz
Igarapé-Assu (Hellmayr); Rio Capim (Wallace); Peixe-Boi, Rio Tocantins, Rio Jamauchim (Snethlage); also Rio Tocantins and Rio Tapajoz (Zimmer)

1 ♂ 2 ♀, Rio Tapajoz, east bank
1 ♂ 3 ♀, Benevides (Carnegie Mus.)
2 ♂ 4 ♀, Santarem (do.)
2 ♂ 4 ♀, Rio Tapajoz, both banks (do.)

Family FORMICARIIDAE

506. Cymbilaimus lineatus lineatus (Leach)

Type locality: Berbice, British Guiana
Rio Jary (Snethlage); Rio Jamundá, Faro (Snethlage and Zimmer)
2 ♂ 2 ♀, Obidos (Carnegie Mus.)

507. Cymbilaimus lineatus intermedius (Hartert and Goodson)

Type locality: Rio Madeira, Brazil
Rio Tocantins, Rio Xingú, Rio Tapajoz (numerous localities, Snethlage and Zimmer)
15 ♂ 2 ♀, Rio Tapajoz, various localities, east bank
5 ♂ 7 ♀, Santarem (Carnegie Mus.)
4 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

It is surprising that this Ant-Shrike should be lacking from the Pará region.

508. Frederickena viridis (Vieillot)

Type locality: Cayenne
10 ♂ 4 ♀, Obidos (Carnegie Mus.)

It is curious that this Ant-Shrike should as yet be unreported from Brazil north of the Amazon.

509. Taraba major semifasciatus (Cabanis)

Type locality: Pará
Pará, (Layard, Natterer, Stone, Wallace); Rio Guamá, Castanhal (Stone); Igarapé-Assu, S. Antonio do Prata, Peixe-Boi (Hellmayr); Quati-puru, Rio Guamá, Rio Moju, Rio Tapajoz, Arumanduba, Monte Alegre, Obidos, Rio Jamundá (Snethlage); Rio Tocantins, Rio Xingú, Villa Bella Imperatriz (Zimmer); Santarem (Hellmayr, Chapman and Riker)
1 ♂ 1 ♀, Rio Tapajoz, east bank
2 ♀, near Obidos
2 ♂, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Benevides (do.)
5 ♂ 2 ♀, Santarem (do.)
3 ♂ 1 ♀, Rio Tapajoz (do.)

510. Sakesphorus luctuosus luctuosus (Lichtenstein)

Type locality: Cametá, Rio Tocantins

Rio Tocantins, Rio Xingú, Rio Iriri, Rio Tapajoz, Rio Jamauchim, Arumanduba, Monte Alegre, Rio Maecuru, Obidos, Rio Jamundá (all Snethlage under the genus Myrmelastes); Santarem (Chapman and Riker, Hellmayr)

3 ♂ 1 ♀, Pará, Val-de-Caes
2 ♂ 2 ♀, Obidos (Carnegie Mus.)
9 ♂ 9 ♀, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz, both banks (do.)
4 ♂ 5 ♀, Rio Tapajoz, various localities, east bank
2 ♂ 1 ♀, near Obidos

It seems surprising that this characteristic lower Amazonian species should have escaped detection previously in the Pará region. The typical form ranges west to the Rio Madeira and is represented in the interior of Goyaz by the little known *araguayae* Hellmayr. *S. hagmanni* Mir.-Ribeiro would appear to be a synonym of the typical form.

511. Thamnophilus doliatus doliatus (Linnaeus)

Type locality: Surinam

Marajo Island (Sclater and Salvin, Allen, Snethlage, Hellmayr; Castanhal, near Pará, Amapá, Monte Alegre (Snethlage); Caviana Island (Brodkorb)

512. Thamnophilus doliatus difficilis Hellmayr

Type locality: Rio Claro, Goyaz, Brazil

Tocantins River (*fide* Hellmayr, 1929)

513. Thamnophilus doliatus signatus Zimmer, 1933

Type locality: Santarem, Brazil

Santarem, (Chapman and Riker, Pinto); Rio Tapajoz, Villa Bella Imperatriz Rio Jamundá (Zimmer); Obidos (Pelzeln)

1 ♂ 2 ♀, Rio Tapajoz, Santarem
4 ♂ 5 ♀, Santarem (Carnegie Mus.)
6 ♂ 9 ♀, Obidos (Carnegie Mus.)

This race is little more than a variable series of intermediates.

514. THAMNOPHILUS PALLIATUS PALLIATUS (Lichtenstein)

Type locality: Bahia, Brazil

Pará (Layard, Stone, Pinto); S. Antonio do Prata (Hellmayr); Quati-puru, Bragança, Rio Guamá, Rio Moju, Rio Tocantins, Rio Tapajoz (Snethlage and Zimmer)

4 ♂ 3 ♀, Benevides (Carnegie Mus.)

Zimmer combines this species with the upper Amazonian *tenuipunctatus*, reviving *puncticeps* Sclater as the connecting form, which ranges from the Rio Madeira to northeastern Peru (cf. Amer. Mus. Novit., no. 646, pp. 9–15).

515. THAMNOPHILUS NIGROCINEREUS NIGROCINEREUS Scalter

Type locality: Rio Tocantins

Mexiana Island (Wallace, Hellmayr, Hagmann); Ilha das Oncas, Marajo Island, Arumanduba, Monte Alegre (Snethlage)

9 ♂ 2 ♀, Pará, Val-de-Caes

1 ♂ 1 ♀, Rio Tocantins, Cametá

516. THAMNOPHILUS NIGROCINEREUS HUBERI Snethlage

Type locality: Ilha de Goyana, Rio Tapajoz

Santarem (Zimmer)

10 ♂ 4 ♀, type locality (Carnegie Mus.)

1 ♂, Rio Tapajoz, Itaituba (do.)

9 ♂ 14 ♀, Santarem, (do.)

The Santarem series is easily separable from the topotypes. Males are minutely paler and greyish on the abdomen, while females are a noticeably less rich rufescent brown below.

517. THAMNOPHILUS AETHIOPS PUNCTULIGER Pelzeln

Type locality: Borba, Rio Madeira

Villa Bella Imperatriz, Rio Jamundá, Faro and Rio Tapajoz, west bank (Zimmer)

11 ♂ 13 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

518. Thamnophilus aethiops atriceps Todd

Type locality: Miriti tuba, Rio Tapajoz
Rio Tapajoz, right or east bank (Todd and Zimmer)
3 ♂ 2 ♀, type locality
6 ♂ 3 ♀, Rio Tapajoz, type series (Carnegie Mus.)
4 ♂ 3 ♀, Santarem (do.)

519. Thamnophilus aethiops incertus Pelzeln

Type locality: Pará
Numerous records by all collectors from the Pará region to the right bank of the Rio Tocantins; see especially Snethlage and Zimmer
4 ♂ 2 ♀, Pará, Bosque, and Val-de-Caes
1 ♀, Rio Acará, Acará
13 ♂ 9 ♀, Benevides (Carnegie Mus.)

The Acará female is remarkably distinct in having the belly and abdomen whitish in striking contrast with the tawny chest.

520. Thamnophilus schistaceus inornatus Ridgway

Type locality: Diamantina, Santarem, Brazil
Rio Tapajoz, left bank (Snethlage and Zimmer); the right bank (Zimmer); Rio Tocantins and Rio Xingú (Zimmer); Santarem (Chapman and Riker)
16 ♂ 16 ♀, Rio Tapajoz, east bank
10 ♂ 8 ♀, Santarem (Carnegie Mus.)
10 ♂ 8 ♀, Rio Tapajoz, both banks

Recorded by Snethlage as *Dysithamnus schistaceus* and *squamosus*. Birds from the left bank of the Rio Tapajoz have often been referred to typical *schistaceus* D'Orbigny.

521. Thamnophilus murinus cayennensis Todd

Type locality: Pied Saut, French Guiana
Obidos, Rio Jamundá, Faro (Snethlage)
11 ♂ 9 ♀, Obidos (Carnegie Mus.)

This species does not occur on the south side of the Amazon in our rea, but *canipennis* Todd crosses the river on the left bank of the Rio Madeira.

522. Thamnophilus punctatus punctatus (Shaw)

Type locality: Cayenne
Rio Jary, Rio Maecuru, Monte Alegre, Obidos, Rio Jamundá (Snethlage) and also Marajo Island according to Snethlage; numerous additional specimens from the north bank recorded by Zimmer
6 ♂ 2 ♀, Obidos (Carnegie Mus.)

523. Thamnophilus punctatus saturatus Todd

Type locality: Villa Braga, left bank, Rio Tapajoz
Both banks of the Rio Tapajoz (Zimmer)
1 ♀, Rio Tapajoz, left bank, Pinhel
7 ♂ 1 ♀, Rio Tapajoz, right bank, Santarem, etc. (Carnegie Mus.)

524. Thamnophilus punctatus stictocephalus Pelzeln

Type locality: São Vincente, Matto Grosso
Right bank of Rio Xingú and left bank, Rio Tocantins (Zimmer)

1 ♂ from Val-de Caes is apparently this race in having the crown feathers extensively white basally, but we have no comparable material. For notes on the identity of this form, cf. Zimmer, 1933, p. 11.

525. Thamnophilus amazonicus amazonicus Sclater

Type locality: Rio Javary, upper Amazon
Villa Bella Imperatriz (Zimmer); Rio Tapajoz, left bank (Snethlage)
3 ♂ 6 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

526. Thamnophilus amazonicus obscurus Zimmer

Type locality: Tauary, Rio Tapajoz
Rio Tapajoz, right bank and Rio Xingu, right bank (Zimmer)
12 ♂ 15 ♀, Rio Tapajoz, east bank
1 ♂ 1 ♀, Santarem (Carnegie Mus.)
5 ♂ 2 ♀, Rio Tapajoz, Miriti-tuba

527. Thamnophilus amazonicus paraensis Todd

Type locality: Benevides, Pará

Innumerable records near Pará (all collectors) west to the Rio Tocantins (Snethlage and Zimmer); on the north bank, Rio Jary (Snethlage) and Rio Jamundá, Faro (Zimmer)

4 ♂ 1 ♀, Pará, Val-de-Caes

6 ♂ 4 ♀, Rio Acará, Acará

In spite of Zimmer's helpful critique on the distinguishing characters of males of this species and *punctatus*, we would just as soon refer some of the males listed above to *punctatus*, were it not for the fact that that species is not recorded from the vicinity of Pará.

528. Pygiptila stellaris stellaris (Spix)

Type locality: province of Pará

Pará (Spix, Stone); Utinga, S. Antonio do Prata, Ipitinga (Hellmayr); Rio Tocantins, Rio Xingú, Rio Iriri, Rio Curuá, Rio Tapajoz, Rio Jamauchim (Snethlage); large series from Utinga to Villa Bella Imperatriz (Zimmer)

1 ♀, Rio Acará, Acará

6 ♂ 3 ♀, Rio Tapajoz, east bank

9 ♂, Santarem (Carnegie Mus.)

22 ♂, 8 ♀, Rio Tapajoz, both banks (do.)

529. Dysithamnus mentalis emiliae Hellmayr

Type locality: S. Antonio do Prata, Brazil

Rio Capim (Goeldi); Quati-puru (Hellmayr); Peixe-Boi, Rio Guamá, Rio Tocantins (Snethlage)

530. Dysithamnus ardesiacus obidensis Snethlage

Type locality: Obidos, Brazil

Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)

14 ♂ 3 ♀, Obidos (Carnegie Mus.)

531. Dysithamnus ardesiacus saturninus (Pelzeln)

Type locality: Borba, Rio Madeira

Rio Tapajoz, left bank (Snethlage and Zimmer); Villa Bella Imperatriz (Zimmer)

16 ♂ 4 ♀, Rio Tapajoz, Villa Braga and Apaçy (Carnegie Mus.)

The interrupted distribution of this genus in Lower Amazonia is of interest. In particular the species *mentalis* is lacking between the Rio Tocantins and northern Matto Grosso.

532. Thamnomanes caesius hoffmansi Hellmayr

Type locality: S. Antonio do Prata, Pará

Pará, Castanhal, Rio Inhangapy (Stone); Igarapé-Assu and Peixe-Boi (Hellmayr); numerous localities near Pará to Rio Tocantins (Snethlage); Rio Xingú (Zimmer)

2 ♂ 1 ♀, Pará, Bosque
2 ♂ 1 ♀, Rio Acará, Acará

533. Thamnomanes caesius persimilis Hellmayr

Type locality: Teffe, Rio Solimões, Brazil

Rio Tapajoz, left bank (Hellmayr, Snethlage, Zimmer); birds variously intermediate are recorded from the right bank of the Rio Tapajoz, Rio Jamauchim and Santarem (Hellmayr, Snethlage and Zimmer)

18 ♂ 15 ♀, Rio Tapajoz, various localities, east bank
2 ♂ 7 ♀, Santarem (Carnegie Mus.)
5 ♂ 12 ♀, Rio Tapajoz, both banks

This is much the largest series studied from this intermediate area. The females in particular are clearly nearer *persimilis* than *hoffmansi*.

534. Thamnomanes caesius glaucus Cabanis

Type locality: Cayenne

Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro and Obidos (Zimmer)

10 ♂ 8 ♀, Obidos (Carnegie Mus.)

The great series in the Carnegie Museum do not endorse Hellmayr's treatment of this group. Seven males and a female from Sao Paulo de Olivença, Rio Solimões, are absolutely inseparable from Cayenne topotypes, indicating that this form ranges much further west in northern Brazil than the Rio Negro. Collected at the same place and on the same day is a typical female of *schistogynus* Hellmayr, surely a curious state of affairs, as this is also a notable range extension. Judging by Zimmer's comments on his Peruvian material and his difficulties with it, it begins to look as if *schistogynus* were specifically distinct.

535. Myrmotherula brachyura brachyura (Hermann)

Type locality: Cayenne
Rio Jary and Obidos (Snethlage); Rio Tocantins, Rio Tapajoz and Rio Jamauchim (Snethlage); Rio Jamundá, Faro (Zimmer)
1 ♂, Rio Tapajoz, Pinhy
10 ♂ 6 ♀, Obidos (Carnegie Mus.)
9 ♂ 5 ♀, Santarem (do.)
18 ♂ 9 ♀, Rio Tapajoz, both banks (do.)

536. Myrmotherula sclateri Snethlage

Type locality: Boim, Rio Tapajoz, Brazil
Large series from the right bank of the same river (Zimmer) and others in the Carnegie Museum
1 ♂, Rio Tapajoz, Caxiricatuba
1 ♀, Santarem (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga and Aveiros (do.)

There are 7 ♂ 3 ♀, from the Rio Purus (Carnegie Mus.), a notable range extension.

537. Myrmotherula surinamensis surinamensis (Gmelin)

Type locality: Surinam
Obidos (Pinto); Rio Jamundá, Faro (Snethlage)
1 ♀, Obidos (Carnegie Mus.)

538. Myrmotherula surinamensis multostriata Sclater

Type locality: Ucayali River, east Peru
Peixe-Boi and S. Antonio do Prata (Hellmayr); numerous localities from Rio Guamá to Rio Tapajoz, (Snethlage); Villa Bella Imperatriz (Zimmer)
2 ♂ 3 ♀, Rio Tapajoz, both banks (Carnegie Mus.)

539. Myrmotherula klagesi Todd

Type locality: Santarem, Brazil
Also islands in the Amazon near Obidos (Todd)
1 ♀ ad., near Obidos, Boca do Igarapé-Piaba
4 ♂, Obidos (Carnegie Mus.)
3 ♂ 2 ♀, Santarem (do.)

This "species" connects the last with *cherriei* Berlepsch and Hartert of the upper Orinoco.

540. Myrmotherula guttata (Vieillot)

Type locality: Cayenne
Rio Jary and Obidos (Snethlage)
16 ♂ 6 ♀, Obidos (Carnegie Mus.)

541. Myrmotherula hauxwelli clarior Zimmer

Type locality: Rio Andirá, west of the Rio Tapajoz, Brazil
Rio Tapajoz, both banks and Rio Jamauchim (Snethlage); same localities and Villa Bella Imperatriz (Zimmer)
1 ♂, Rio Tapajoz, Caxiricatuba
9 ♂ 6 ♀, Santarem (Carnegie Mus.)
4 ♂ 5 ♀, Rio Tapajoz, both banks (do.)

542. Myrmotherula hauxwelli hellmayri Snethlage

Type locality; near Pará, Brazil
Peixe-Boi, Igarapé-Assu, S. Antonio do Prata (Hellmayr); Rio Capim (Wallace); numerous localities, Pará (Stone) to Rio Tocantins (Snethlage); Rio Xingi (Zimmer)
3 ♀, Pará, Bosque
1 ♀, Rio Acará, Acará
7 ♂ 7 ♀, Benevides (Carnegie Mus.)

543. Myrmotherula gutturalis Salvin and Godman

Type locality: Bartica Grove, British Guiana
Rio Jary and Obidos (Snethlage); Faro (Zimmer)
6 ♂ 5 ♀, Obidos (Carnegie Mus.)

This species represents *erythrura* of upper Amazonia.

544. Myrmotherula leucophthalma phaeonota Todd

Type locality: Villa Braga, left bank, Rio Tapajoz
Numerous localities, left bank Rio Tapajoz (Snethlage, Todd, Zimmer)
1 ♀, Rio Tapajoz, Pinhel
12 ♂ 5 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

This Ant-Wren is sometimes considered to be a race of *haematonota*.

545. Myrmotherula leucophthalma sordida Todd

Type locality: Colonia do Mojuy, Santarem, Brazil
Marajo Island, Rio Tocantins, Rio Xingu, Rio Jamauchim (Snethlage)
6 ♂ 8 ♀, Santarem (Carnegie Mus.)
11 ♂ 14 ♀, Rio Tapajoz, east bank (M.C.Z.)
3 ♂ 7 ♀, (do.), (do.) (Carnegie Mus.)

546. Myrmotherula ornata hoffmannsi Hellmayr

Type locality: Itaituba, Rio Tapajoz, Brazil
Rio Tocantins to Rio Tapajoz (Snethlage, Zimmer, Pinto)
5 ♂ 4 ♀, Rio Tapajoz, east bank
5 ♂ 5 ♀, Santarem (Carnegie Mus.)
7 ♂ 9 ♀, Rio Tapajoz, both banks

547. Myrmotherula axillaris axillaris (Vieillot)

Type locality: Cayenne
S. Antonio do Prata (Hellmayr); Rio Capim (Wallace); Peixe-Boi and Ipitinga (Hellmayr); Santarem (Chapman and Riker; Hellmayr); Obidos (Hellmayr, Pinto); great series from entire area (Snethlage and Zimmer)
1 ♂, Rio Acará, Acará
16 ♂ 6 ♀, Rio Tapajoz, east bank
2 ♂ 2 ♀, Obidos (Carnegie Mus.)
3 ♂, Benevides (do.)
15 ♂ 6 ♀, Santarem (do.)
13 ♂ 6 ♀, Rio Tapajoz, both banks (do.)

548. Myrmotherula longipennis longipennis Pelzeln

Type locality: Marabitanas, Rio Negro
San Antonio de Cachoeira, Rio Jary (Snethlage)

549. Myrmotherula longipennis ochrogyna Todd

Type locality: Villa Braga, left bank, Rio Tapajoz
Villa Bella Imperatriz (Zimmer); left bank of the Tapajoz (Snethlage and Zimmer)
11 ♂ 5 ♀, type locality (Carnegie Mus.)

550. Myrmotherula longipennis paraensis (Todd)

Type locality: Benevides, Pará
Igarapé-Assu, S. Antonio do Prata, Peixe-Boi (Hellmayr); Rio Capim (Wallace); numerous localities Rio Guamá and Pará region to right bank of Rio Tapajoz (Snethlage and Zimmer, Stone)
1 ♂, Pará, Bosque
3 ♂ 3 ♀, Rio Tapajoz, east bank
8 ♂ 5 ♀, Benevides (Carnegie Mus.)
8 ♂ 1 ♀, Rio Tapajoz, east bank (do.)

551. Myrmotherula iheringi iheringi Snethlage

Type locality: Boim, left bank of Rio Tapajoz
Boim and Villa Braga (Snethlage)
1 ♂, Villa Braga (ex Carnegie Mus.)
8 ♂ 4 ♀, Villa Braga (do.)

This little known species is closely related to *minor* Salvadori of southeastern Brazil and *garbei* Ihering of the Rio Juruá. It is otherwise known only from the Rio Madeira and northern Matto Grosso.

552. Myrmotherula menetriesii cinereiventris Sclater & Salvin

Type locality: Cayenne
Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)
1 ♂ 2 ♀, Obidos (Carnegie Mus.)

553. Myrmotherula menetriesii omissa Todd

Type locality: Benevides, Pará
Igarapé-Assu, S. Antonio do Prata, Peize-Boi (Hellmayr); Santarem (Chapman and Riker); numerous localities, Rio Guamá to Rio Jamauchim (Snethlage); Rio Tapajoz, Tauary (Zimmer)
1 ♀, Rio Acará, Acará
9 ♂ 6 ♀, Rio Tapajoz, east bank
3 ♂ 2 ♀, (do.) (do.) (Carnegie Mus.)
6 ♂ 2 ♀, Benevides (do.)
2 ♂ 1 ♀, Santarem (do.)

554. Myrmotherula menetriesii berlepschi Hellmayr

Type locality: Salto do Girao, Rio Madeira
left bank of Rio Tapajoz (Snethlage and Hellmayr)
13 ♂ 5 ♀, Rio Tapajoz, west bank (Carnegie Mus.)

555. Myrmotherula assimils Pelzeln

Type locality: below Barcellos, Rio Negro
Santarem (Ihering); Rio Jamundá, Faro (Snethlage, Zimmer); Villa Bella Imperatriz (Zimmer)
1 ♂ 1 ♀, near Obidos
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
18 ♂ 13 ♀, Santarem (do.)

This rare species has a curious distribution, suggesting incomplete knowledge. It is well represented from the Rio Negro and the Rio Madeira, and turns up in northeastern Peru.

556. Dichrozona cincta zononota Ridgway

Type locality: Diamantina, Santarem, Brazil
Diamantina (Chapman and Riker); Villa Bella Imperatriz and Rio Tapajoz (Zimmer)
1 ♂ 2 ♀, Rio Tapajoz, Pinhy and Pataua
2 ♂, Santarem (Carnegie Mus.)
15 ♂ 6 ♀, Rio Tapajoz (do.)

A rare antbird with a widely scattered distribution in upper Amazonia.

557. Herpsilochmus sticturus sticturus Salvin

Type locality: Bartica Grove, British Guiana
2 ♂, Obidos (Carnegie Mus.)
Previously unrecorded from Brazil.

558. Herpsilochmus rufimarginatus frater Sclater and Salvin

Type locality: Sarayacu, east Ecuador
Peixe-Boi and Marajo Island (Snethlage)
1 ♂, Rio Tapajoz, Caxiricatuba
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
2 ♀, Santarem (do.)

In default of topotypical material, we can only follow Hellmayr in referring lower Amazonian specimens to *frater*. The bird is still very rare in collections.

559. Microrhopias quixensis bicolor (Pelzeln)

Type locality: Rio Madeira
Itaituba (Hellmayr); left bank of Rio Tapajoz (Snethlage and Zimmer); Villa Bella Imperatriz (Zimmer)
29 ♂ 22 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

560. Microrhopias quixensis emiliae Chapman

Type locality: Alta Mira. Rio Xingú
Rio Tocantins (Chapman); Rio Tapajoz, right bank (Zimmer)
2 ♂ 3 ♀, Santarem (Carnegie Mus.)
4 ♂ 3 ♀, Rio Tapajoz, right bank (do.)

561. Microrhopias quixensis microsticta (Berlepsch)

Type locality: Rio Approuague, French Guiana
Rio Jary and Arumanduba (Snethlage)

562. Formicivora grisea grisea (Boddaert)

Type locality: Cayenne
Pará (Layard, Natterer, Stone); Castanhal (Stone); S. Antonio do Prata (Hellmayr); Rio Capim (Goeldi); Santarem (Chapman and Riker; Hellmayr, Pinto); numerous localities, Pará, Rio Guamá and Marajo Island to left bank of Rio Tocantins, Amapá, and Monte Alegre on north bank (Snethlage)
4 ♂ 2 ♀, Pará, Val-de-Caes
8 ♂ 10 ♀, Rio Tapajoz, east bank
7 ♂ 3 ♀, Benevides (Carnegie Mus.)
7 ♂ 9 ♀, Santarem (do.)
5 ♂ 4 ♀, Rio Tapajoz (do.)

563. Formicivora rufa chapmani Cherrie

Type locality: Altar do Chao, Rio Tapajoz
Santarem (Chapman and Riker; Pinto); Rio Acará, Monte Alegre, Serra de Ereré, Rio Maecuru (Snethlage)
5 ♂ 4 ♀, Rio Tapajoz, Santarem
12 ♂ 7 ♀, Santarem (Carnegie Mus.)

Birds from the north bank of the Amazon in the Museu Goeldi may represent an undescribed form.

564. Drymophila devillei subochracea Chapman

Type locality: Rio Curua, lower Rio Xingú
Known only from the ♀ type

565. Terenura spodioptila elaeopteryx Leverkühn

Type locality: Cayenne
S. Antonio da Cachoeira, Rio Jary (Snethlage); Rio Jamundá, Faro (Zimmer)
2 ♂ 1 ♀, Obidos (Carnegie Mus.)

566. Terenura spodioptila meridionalis Snethlage

Type locality: Villa Braga, Rio Tapajoz
Rio Tapajoz, left bank (Zimmer)
2 ♂ 2 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

567. Cercomacra cinerascens immaculata Chubb

Type locality: Supenaam, British Guiana
Rio Jamundá, Faro (Zimmer)
13 ♂ 4 ♀, Obidos (Carnegie Mus.)

568. Cercomacra cinerascens iterata Zimmer

Type locality: Caxiricatuba, Rio Tapajoz
Igarapé-Assu, S. Antonio do Prata, Santarem (Hellmayr); Rio Guamá, Rio Capim, Rio Tocantins, Rio Jamauchim, Rio Tapajoz left bank (Snethlage); Rio Tocantins and Rio Tapajoz (Zimmer)
2 ♂, Rio Tapajoz west bank, Pinhel
6 ♂ 2 ♀, Rio Tapajoz east bank, various localities
2 ♂, Benevides (Carnegie Mus.)
3 ♂ 4 ♀, Santarem (do.)
17 ♂ 8 ♀, Rio Tapajoz, both banks (do.)

569. Cercomacra tyrannina laeta Todd

Type locality: Benevides, Pará
Pará (Layard, Natterer, Stone); Igarapé-Assu, S. Antonio do Prata, Peixe-Boi, Ipitinga, Obidos (Hellmayr); numerous localities, Rio Guamá, Pará region to Rio Tocantins, and whole of north bank to Rio Jamundá (Snethlage)
6 ♂ 5 ♀, Pará, Bosque, and Val-de-Caes
8 ♂ 11 ♀, Obidos (Carnegie Mus.)
11 ♂ 4 ♀, Benevides (do.)

570. Cercomacra nigrescens (Cabanis and Heine)

Type locality: Cayenne
Rio Jamundá, Faro (Snethlage)
1 ♂, Obidos (Carnegie Mus.)

571. Cercomacra nigrescens approximans Pelzeln

Type locality: Engenho do Gama, Matto Grosso
Santarem (Hellmayr); Rio Tocantins, Rio Tapajoz, left bank (Snethlage); Villa Bella Imperatriz and other localities (Zimmer)
10 ♂ 8 ♀, Rio Tapajoz, east bank
12 ♂ 7 ♀, (do.), both banks (Carnegie Mus.)
10 ♂ 5 ♀, Santarem (do.)

572. Pyriglena leucoptera leuconota (Spix)

Type locality: Pará, Brazil
Pará (Spix, Layard, Natterer, Wallace, Stone); Souza, Igarapé-Assu, Peixe-Boi, S. Antonio do Prata (Hellmayr); Murutucu (Munich Museum); numerous localities, Rio Guamá, Pará region to Rio Tocantins and Rio Curuá (Snethlage); Utinga (Pinto)
7 ♂ 4 ♀, Pará, Val-de-Caes
1 ♀, Rio Acará, Acará
3 ♂, Rio Tocantins, Cametá
12 ♂ 10 ♀, Benevides (Carnegie Mus.)

573. Pyriglena leucoptera similis Zimmer, 1931

Type locality: Caxiricatuba, Rio Tapajoz
2 ♂ 5 ♀, Rio Tapajoz, Santarem
3 ♂ 1 ♀, (do.), both banks (Carnegie Mus.)
9 ♂ 3 ♀, Santarem (do.)

574. Myrmoborus leucophrys subsp.

Itaituba (Hellmayr); Rio Tocantins and Rio Jamauchim (Snethlage and Zimmer)
8 ♂ 3 ♀, Rio Tapajoz, both banks (Carnegie Mus.)

Zimmer's study of this species (Amer. Mus. Novit., no. 545, 1932, pp. 1–5) lists a "subsp. ?" of which he had been able to examine only 2 specimens from the Rio Tocantins and 1 from the Rio Jamauchim. His *griseigula* was based on a series from the left bank of the Rio

Madeira. The adult male is closest to *angustirostris*, merely averaging a little darker on the belly. The females, however, differ in just the respects ascribed by Zimmer to *griseigula*, but the under tail-coverts are almost pure white instead of buffy brown. We have here a rather poorly characterized intermediate, which Mr. Todd does not care to describe. With no material of our own we are unable to do so either, but somebody will most certainly do so in the future.

575. Myrmoborus leucophrys angustirostris (Cabanis)

Type locality: coastal forests of British Guiana, Cunany, Rio Jary, Rio Maecuru (Snethlage)

576. Myrmoborus lugubris lugubris (Cabanis)

Type locality: Pará, Brazil

Santarem (Chapman and Riker); Monte Alegre, Obidos, Rio Jamundá (Snethlage); Rio Tocantins, Rio Xingú, Villa Bella Imperatriz (Zimmer)

1 ♂, Pará, Val-de-Caes
6 ♂ 4 ♀, north bank of Amazon near Obidos
1 ♂, Rio Tapajoz, Santarem
7 ♂, Obidos (Carnegie Mus.)
16 ♂ 13 ♀, Santarem (do.)

577. Myrmoborus myotherinus ochrolæma (Hellmayr)

Type locality: Itaituba, left bank, Rio Tapajoz

Rio Tocantins, Rio Xingú, Rio Jamauchim, Rio Tapajoz (Snethlage and Zimmer)

4 ♂, Pará, Val-de-Caes
8 ♂ 4 ♀, Rio Tapajoz, east bank
1 ♀, Rio Tapajoz, west bank (Pinhel)
19 ♂ 12 ♀, Santarem (Carnegie Mus.)
15 ♂ 9 ♀, Rio Tapajoz, both banks (do.)

We cannot find that this species has been reported east of the Rio Tocantins. The four Pará males are minutely paler below, but unfortunately we have no females.

578. Hypocnemis cantator cantator (Boddaert)

Type locality: Cayenne

Obidos, (Hellmayr, Snethlage, Zimmer, Pinto); Rio Jamundá, Faro (Snethlage and Zimmer)

2 ♂ 1 ♀, Obidos (Carnegie Mus.)

579. Hypocnemis cantator affinis Zimmer, 1932

Type locality: Baião, Rio Tocantins
Rio Tocantins and Rio Xingú, right bank (Snethlage, Zimmer)

580. Hypocnemis cantator striata (Spix)

Type locality: Santarem
Rio Jamauchim, Rio Tapajoz, both banks (Snethlage and Zimmer)
12 ♂ 11 ♀, 2 ? , Rio Tapajoz, both banks
7 ♂ 3 ♀, Santarem (Carnegie Mus.)
9 ♂ 5 ♀, Rio Tapajoz, both banks (do.)

581. Hypocnemis cantator implicata Zimmer, 1932

Type locality: near Borba, Rio Madeira
Villa Bella Imperatriz (Zimmer)

582. Hypocnemis hypoxantha ochraceiventris Chapman

Type locality: Alta Mira, Rio Xingú
Rio Tapajoz, east bank, (Carnegie Mus. and Zimmer)
5 ♂ 4 ♀, Rio Tapajoz, east bank
15 ♂ 8 ♀, Rio Tapajoz, (do.), (Carnegie Mus.)

583. Hypocnemoides melanopogon melanopogon (Scalter)

Type locality: Guiana
North bank, Rio Jary, Arumanduba, Obidos, Rio Jamundá (Snethlage); Mexiana Island (Wallace, Hellmayr); Rio Tocantins (Snethlage, Zimmer); Rio Xingú, Rio Tapajoz, Villa Bella Imperatriz (Zimmer)
3 ♂, Pará, Val-de-Caes
2 ♂ 1 ♀, near Obidos
1 ♂ 2 ♀, Obidos (Carnegie Mus.)
5 ♂ 4 ♀, Santarem (do.)

Snethlage and Hellmayr have both commented on the peculiarly overlapping ranges of *melanopogon* and *maculicauda*. Recent collections show that there is little or nothing in this; the Pará specimens of *melanopogon* listed above now show that species to have a continuous range on the south bank of the Amazon.

584. Hypocnemoides maculicauda (Pelzeln)

Type locality: Matta Grosso
Rio Capim (Goeldi); Pará, S. Antonio do Prata, Rio Acará, Rio Iriri, Rio Jamauchim, Rio Tapajoz (Snethlage)
2 ♂ 1 ♀, Rio Tapajoz, east bank
7 ♂ 8 ♀, (do.) both banks (Carnegie Mus.)

It will be noted that both species are now known from the Pará region and the east bank of the Tapajoz.

585. Percnostola rufifrons rufifrons (Gmelin)

Type locality: Cayenne
San Antonio do Cachoeira, Rio Jary, Obidos (Snethlage, Hellmayr, Zimmer, Pinto)
10 ♂ 9 ♀, Obidos (Carnegie Mus.)

586. Percnostola rufifrons subcristata Hellmayr

Type locality: Manaos
Rio Jamundá, Faro, (Snethlage, Zimmer)

587. Sclateria naevia naevia (Gmelin)

Type locality: Surinam
Pará, Peixe-Boi, Rio Acará (Hellmayr); Pará, S. Antonio do Prata, Ilha das Oncas, Rio Acará (Snethlage); Pará (Stone)

The series from Obidos are perfect intermediates between this and the next.

588. Sclateria naevia toddi Hellmayr

Type locality: Santarem, Brazil
1 ♀, Rio Tapajoz, Tauary
3 ♂ 2 ♀, Obidos (Carnegie Mus.)
5 ♂ 5 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)

589. Schistocichla leucostigma leucostigma (Pelzeln)

Type locality: Manaos
Obidos (Hellmayr, 1929)
1 ♂, Obidos (Carnegie Mus.)

590. Schistocichla leucostigma rufifacies Hellmayr

Type locality: Apaçy, Rio Tapajoz, Brazil
Arumatheua, Rio Tocantins (Snethlage); Santarem and Villa Braga (Hellmayr); Villa Imperatriz and Serra do Parintins (Zimmer)
2 ♂ 1 ♀, Rio Tapajoz, east bank
1 ♀, Santarem (Carnegie Mus.)
3 ♂ 2 ♀, Rio Tapajoz, left bank, including type

591. Myrmeciza longipes griseipectus Berlepsch & Hartert

Type locality: Caicara, Venezuela
Obidos (Hellmayr, Pinto); Monte Alegre, Ereré, Rio Maecuru (Snethlage)
1 ♂ imm., near Obidos
24 ♂ 11 ♀, Obidos (Carnegie Mus.)

592. Myrmeciza ferruginea ferruginea (P.L.S. Müller)

Type locality: Cayenne
Cunany, Rio Jary, Obidos, Rio Jamundá (Snethlage); Obidos (Hellmayr, Pinto)
3 ♂ 1 ♀ Obidos (Carnegie Mus.)

593. Myrmeciza ferruginea eluta (Todd)

Type locality: Villa Braga, Rio Tapajoz
9 ♂ 6 ♀, Rio Tapajoz, left bank (Carnegie Mus.)

Only known from the type locality, where first found by Snethlage, to the right bank of the Rio Madeira.

594. Myrmeciza atrothorax atrothorax (Boddaert)

Type locality: Cayenne
Rio Jamundá, Faro (Snethlage); Marajo Island (Snethlage)

The subspecies of the Marajo Island bird still remains to be determined.

595. Myrmeciza atrothorax melanura (Menetries)

Type locality: Cuyabá, Matto Grosso
Igarapé Brabo, left bank, Rio Tapajoz, 1 ♂ (Zimmer)

596. Myrmeciza atrothorax stictothorax (Todd)

Type locality: Apaçy, Rio Tapajoz
1 ♂ 1 ♀, Rio Tapajoz, Apaçy (Carnegie Mus.)

Only known from the two original specimens. As Zimmer very justly remarks, more material from the Tapajoz is needed.

597. Myrmeciza hemimelaena pallens Berlepsch and Hellmayr

Type locality: Villa Bella de Matto Grosso
Rio Xingú, Cussary, Tamucury, Rio Tapajoz (Snethlage)
16 ♂ 10 ♀, Rio Tapajoz, east bank
5 ♂ 5 ♀, (do.) both banks (Carnegie Mus.)
12 ♂ 11 ♀, Santarem (do.)

598. (Myrmeciza dubia Snethlage

Type locality: Rio Iriri (tributary of the Xingú)

Snethlage, in her original description (1925), places this species in the genus Myrmeciza with a good deal of doubt. She seems to have been under the impression that Drymophila Swainson is a synonym of Myrmeciza G. R. Gray. The type, which we suppose is in the Goeldi Museum at Pará, should be examined.

599. Formicarius colma colma Boddaert

Type locality: Cayenne
Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)
2 ♂ 3 ♀, Obidos (Carnegie Mus.)

600. Formicarius colma amazonicus Hellmayr

Type locality: Borba, Rio Madeira
Pará (Natterer, Snethlage); Igarapé-assu, S. Antonio do Prata, Peixe-Boi, Ipitinga, (Hellmayr); Benevides, Sta. Isabel, Rio Tocantins, Rio Iriri, Rio Jamauchim, Rio Tapajoz, (Snethlage); Rio Tocantins, Rio Tapajoz, Villa Bella Imperatriz (Zimmer)
4 ♂ 2, Rio Tapajoz, both banks
13 ♂ 5 ♀, Santarem (Carnegie Mus.)
2 ♀, Rio Tapajoz, left bank (do.)

601. Formicarius analis analis (Lafresnaye and D'Orbigny)

Type locality: Yuracares, Bolivia

Pará (Wallace, Stone); Rio Guamá (Stone); Peixe-Boi (Hellmayr); Providencia, Benevides, Maguary, Rio Guamá, Rio Acará, Rio Tocantins, Rio Tapajoz (Snethlage); Villa Bella Imperatriz (Zimmer)

4 ♂, Pará, Bosque, and Val-de-Caes
1 ♂, Rio Acará, Acará
1 ♂, Rio Tapajoz, Caxiricatuba
8 ♂ 3 ♀, Benevides (Carnegie Mus.)
6 ♂ 4 ♀, Santarem (do.)
3 ♂, Rio Tapajoz, both banks

602. Formicarius analis crissalis (Cabanis)

Type locality: Roraima, British Guiana

Monte Alegre (Snethlage), the identification requiring confirmation

603. Chamaeza nobilis fulvipectus Todd

Type locality: Colonia do Mojuy, Santarem, Brazil

The type in Carnegie Museum examined.

604. Pithys albifrons albifrons (Linnaeus)

Type locality: Cayenne

Obidos, Rio Jamundá, Faro (Snethlage and Zimmer)

4 ♂ 2 ♀, Obidos (Carnegie Mus.)

605. Gymnopithys rufigula rufigula (Boddaert)

Type locality: Cayenne

Obidos and Rio Jamunda, Faro (Snethlage)

7 ♂ 4 ♀, Obidos (Carnegie Mus.)

606. Rhegmatorhina gymnops Ridgway

Type locality: Diamantina, near Santarem, Brazil

Santarem (Chapman and Riker); Rio Curuá, Rio Tapajoz, Rio Jamauchim (Snethlage); Rio Tapajoz (Pinto)

1 ♂ 1 ♀, Mirituba and Colonia de Mojuy, Rio Tapajoz
2 ♂ 4 ♀ 1 ?, (do.) (Carnegie Mus.)
3 ♂ 3 ♀, Santarem (Carnegie Mus.)

607. Rhegmatorhina berlepschi (Snethlage)

Type locality: Villa Braga, left bank, Rio Tapajoz
Boim (Snethlage)
1 ♂ 1 ♀, Villa Braga
10 ♂ 10 ♀, (do.) (Carnegie Mus.)

608. Hylophylax naevia theresae (Des Murs)

Type locality: Rio Javari, northeast Peru
Villa Braga, left bank of Rio Tapajoz (Hellmayr)
8 ♂ 9 ♀, Rio Tapajoz, left bank (do.)

Recorded by Snethlage as the next race. This locality marks the easternmost point in the range of *theresae*.

609. Hylophylax naevia ochracea (Berlepsch)

Type locality: Tucunaré, Rio Jamauchim
Rio Tocantins, Rio Xingú, Rio Tapajoz, right bank (Snethlage)
5 ♂, Rio Tapajoz, right bank
14 ♂ 6 ♀, (do.) (do.) (Carnegie Mus.)
1 ♀, Santarem (do.)

610. Hylophylax punctulata subochracea Zimmer, 1934

Type locality: Limoal, left bank, Rio Tapajoz
Rio Curuá (Snethlage, fide Hellmayr); Rio Tapajoz, both banks and Rio Xingú, Tapara (Zimmer)
5 ♂, Rio Tapajoz, both banks (Carnegie Mus.)
3 ♂ 1 ♀, Santarem (do.)

611. Hylophylax poecilonota poecilonota (Cabanis)

Type locality: Cayenne
Obidos, (Snethlage); Rio Jamundá, Faro (Zimmer)
8 ♂ 2 ♀, Obidos (Carnegie Mus.)

612. Hylophylax poecilonota nigrigula (Snethlage)

Type locality: Boim, Rio Tapajoz
Villa Bella Imperatriz and Rio Tapajoz, both banks (Zimmer)
9 ♂ 7 ♀, Rio Tapajoz, east bank

613. Hylophylax poecilonota vidua (Hellmayr)

Type locality: Igarapé-Assu, Rio Acará, Pará

Pará, Peixe-Boi, S. Antonio do Prata (Hellmayr); numerous localities, Rio Guamá and Pará (Stone) to Rio Tocantins (Snethlage); Rio Xingú and elsewhere (Zimmer); Rio Capim, Rio Inhangapy (Stone)

5 ♂ 7 ♀, Pará, Bosque and Val-de-Caes
2 ♂, Rio Acará, Acará
10 ♂ 13 ♀, Benevides (Carnegie Mus.)

614. Phlegopsis nigro-maculata bowmani Ridgway

Type locality: Diamantina, Santarem, Brazil

Santarem (Chapman and Riker); Rio Curuá, Rio Jamauchim, Rio Tapajoz (both banks) (Snethlage); Villa Bella Imperatriz and both banks of Rio Tapajoz (Zimmer)

6 ♂ 3 ♀, Rio Tapajoz, east bank
15 ♂ 9 ♀, Santarem (Carnegie Mus.)
9 ♂ 4 ♀, Rio Tapajoz, west bank (do.)

615. Phlegopsis nigro-maculata confinis Zimmer

Type locality: Tapará, Rio Xingú

Only known from the banks of the Rio Xingú (Zimmer)

Snethlage, 1926, comments on this subspecies on p. 55, and predicts that the bird between the Xingu and Rio Tocantins will prove separable.

616. Phlegopsis nigro-maculata paraensis Hellmayr

Type locality: Pará

Pará (Natterer, Wallace, Stone); Murutucu, Igarapé-Assu (Hellmayr); Rio Capim (Goeldi); Rio Guamá, vicinity of Pará and Rio Tocantins (Snethlage); Rio Guamá to Rio Tocantins (Zimmer); Murutucu (Pinto)

6 ♂ 6 ♀, Benevides (Carnegie Mus.)

617. Phlegopsis borbae Hellmayr

Type locality: Borba, Rio Madeira

Villa Braga, left bank of Rio Tapajoz (Hellmayr), 1 ♂ ad. in Carnegie Museum, examined by us

618. Myrmornis torquata (Boddaert)

Type locality: Cayenne

Peixe-Boi, Rio Tocantins, Cussary and Rio Tapajoz (Snethlage); Santarem (Allen); Aveiro (Pinto)

1 ♀, Rio Tapajoz, Caxiricatuba
2 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Benevides (do.)
4 ♂ 4 ♀, Santarem (do.)
4 ♂ 4 ♀, Rio Tapajoz, both banks (do.)

619. Myrmothera campanisona campanisona (Hermann)

Type locality: Cayenne

Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)

1 ?, near Obidos
7 ♂ 4 ♀, Obidos (Carnegie Mus.)

620. Myrmothera campanisona subcanescens Todd

Type locality: Colonia de Mojuy, Santarem, Rio Jamauchim (Snethlage); both banks of Rio Tapajoz (Todd); Aveiro (Pinto)

1 ♂ 6 ♀, Rio Tapajoz, east bank
13 ♂, 3 ♀, (do.), both banks (Carnegie Mus.)
6 ♂ 1 ♀, Santarem (do.)

621. Grallaria varia distincta Todd

Type locality: Villa Braga, Rio Tapajoz

1 ♂, Santarem
4 ♂, Rio Tapajoz, Villa Braga, Apaçy, and Itaituba (Carnegie Mus.)

This rare bird is otherwise reported only from Calamá, Rio Madeira.

622. Grallaria berlepschi Hellmayr

Type locality: Engenho do Gama, western Matto Grosso

Cussary (Snethlage); Santarem (Todd, in Carnegie Museum)

2 ♂ 2 ♀, Rio Tapajoz, east bank
20 ♂ 5 ♀, Santarem
1 ♂, Rio Tapajoz, Miriti tuba (Carnegie Mus.)

623. Grallaria macularia macularia (Temminck)

Type locality: Cayenne
1 ♀, Obidos (Carnegie Mus.)

The first definite record for Brazil.

624. Grallaria macularia paraensis Snethlage

Type locality: Ourem, Rio Guamá, Pará, Brazil
Also from Rio Acará and Rio Jamauchim (Snethlage)
1 ♂, Miriti tuba, Rio Tapajoz (ex Carnegie Mus.)
3 ♂ 2 ♀, Santarem (Carnegie Mus.)
3 ♂, Rio Tapajoz, Miriti tuba and Villa Braga (do.)

The specimens from Villa Braga have distinct shaft streaks as in typical *macularia*.

Family CONOPOPHAGIDAE

625. Conopophaga aurita aurita (Gmelin)

Type locality: Cayenne
Rio Jamundá, Faro (Zimmer)

626. Conopophaga aurita pallida Snethlage

Type locality: Cametá, left bank of Rio Tocantins

Only the three original specimens are recorded.

627. Conopophaga aurita snethlageæ Berlepsch

Type locality: Tucunaré. Rio Jamauchim
Cussary and type locality (Snethlage); Rio Tapajoz, both banks (Zimmer, Pinto)
9 ♂, Rio Tapajoz, various localities, east bank
4 ♂ 2 ♀, Santarem (Carnegie Mus.)
12 ♂ 10 ♀, Rio Tapajoz, both banks (do.)

628. Conopophaga melanogaster Ménétriès

Type locality: Rio Maderia
Rio Tocantins and Rio Tapajoz, left bank (Snethlage)
1 ♂, Rio Tapajoz, Boim
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (ex Carnegie Mus.)
14 ♂ 6 ♀, Rio Tapajoz, Apaçy, Villa Braga, Itaituba (Carnegie Mus.)

629. Conopophaga roberti Hellmayr

Type locality: Igarapé-Assu, Pará, Brazil
Peixe-Boi, Ipitinga, S. Antonio do Prata (Hellmayr); numerous localities near Pará to Rio Tocantins (Snethlage); Pará and Castanhal (Stone); Prata (Pinto)
1 ♂ 2 ♀, Pará, Bosque
2 ♂ 1 ♀, Rio Acará, Acará
9 ♂ 3 ♀, Benevides (Carnegie Mus.)

630. Corythopis torquata anthoides (Pucheran)

Type locality: Cayenne
Pará (Wallace, Stone); Castanhal (Stone); Igarapé-Assu, S. Antonio do Prata (Hellmayr); Providencia, Ananindeua, Obidos (Snethlage)
1 ♀, Rio Acará, Acará
3 ♂, Rio Tapajoz, Pinhy, Caxiricatuba
9 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
2 ♂, Santarem (do.)
7 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

Family RHINOCRYPTIDAE

631. Liosceles thoracicus thoracicus (Sclater)

Type locality: left bank of Rio Madeira
Villa Bella Imperatriz (Zimmer); Rio Tapajoz, Villa Braga (Snethlage)
1 ♂ 1 ♀, Villa Braga, left bank, Rio Tapajoz (ex Carnegie Museum)
13 ♂ 4 ♀, (do.) Carnegie Mus.)

This rare bird has only recently been found east of the Rio Madeira. Zimmer has shown that Peruvian records should be transferred to *erithacus,* leaving true *thoracicus* with an exceedingly restricted range.

Family COTINGIDAE

632. Phoenicircus carnifex (Linnæus)

Type locality: Surinam

Pará (Natterer, Wallace); Ipitinga (Hellmayr); Rio Guamá, Pará region and Rio Tocantins (Snethlage); Santarem and Villa Braga, Rio Tapajoz (Hellmayr, in Carnegie Museum)

2 ♂ 2 ♀, Rio Tapajoz, Caxiricatuba
1 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
5 ♂ 4 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

633. Phoenicircus nigricollis Swainson

Type locality: Barcellos, Rio Negro, Brazil

Villa Braga and Miriti tuba, Rio Tapajoz (Hellmayr) in Carnegie Museum;
1 ♂, 1 ♀, examined by us
2 ♀, Rio Tapajoz, Tauary and Caxiricatuba

These two species apparently occur together on the Rio Tapajoz, *carnifex* primarily northern and eastern, *nigricollis* upper Amazonian.

634. Cotinga cotinga (Linnæus)

Type locality: "Brazil"

Pará (Natterer, Wallace); Providencia (Snethlage); Santarem (Chapman and Riker); series from vicinity of Pará in Museo Paulista (Cunha Vieiro)

635. Cotinga cayana (Linnæus)

Type locality: Cayenne

Pará (Natterer, Stone); Peixe-Boi and Ipitinga (Hellmayr); Rio Inhangapy (Stone); Pará region, Rio Acará, Rio Tocantins, Rio Tapajoz, (Snethlage); Santarem (Chapman and Riker)

1 ♂ 3 ♀, Obidos (Carnegie Mus.)
2 ♀, Benevides (do.)

636. Xipholena punicea (Pallas)

Type locality: Surinam

Rio Jamundá, Faro (Snethlage)
2 ♂, Obidos (Carnegie Mus.)

637. Xipholena lamellipennis lamellipennis (Lafresnaye)

Type locality; Pará, by subsequent designation
Pará (Natterer, Wallace); Peixe-Boi, Ipitinga, Igarapé-Assu (Hellmayr); Pinheiro (Stone); Pará region and Rio Tocantins (Snethlage)
4 ♂ 3 ♀, Pará, Val-de-Caes
4 ♂ 2 ♀, Benevides (Carnegie Mus.)

638. Xipholena lamellipennis pallidior Griscom & Greenway

Rio Tapajoz, Boim (Snethlage)
4 ♂ 4 ♀, Rio Tapajoz, Pinhy, and Santarem
1 ♂, Santarem (Carnegie Mus.)
2 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

The two species of the genus in our area have a somewhat unusual distribution, as *punicea* the "northern" one, crosses the Amazon west of our area and occurs along the Rio Madeira.

639. Iodopleura isabellae Parzudaki

Type locality: Rio Nigro, "in Venezuela"
Pará (Layard); Marajo Island (Hellmayr); Providencia and Rio Tocantins (Snethlage); Pinheiro (Stone); Obidos and Murutucu (Cunha Vieiro)
2 ♂ 1 ♀ 1 ?, Benevides (Carnegie Mus.)

A little known bird, which reappears on the Rio Solimoës and Rio Purus, and thence extends to eastern Colombia, Ecuador, and Peru. Its relationship to other "species" in the genus still remains to be determined.

640. Attila spadiceus spadiceus (Gmelin)

Type locality: Cayenne
Benevides, Providencia, Rio Tocantins, Rio Tapajoz, Cussary, Monte Alegre, Obidos (Snethlage); Utinga (Beebe); Rio Tapajoz, numerous localities (Hellmayr, series in Carnegie Museum); Santarem (Ridgway; Chapman and Riker)
1 ♂, Pará, Bosque
2 ♂ 2 ♀, Rio Tapajoz, east bank
2 ♀, Benevides (Carnegie Mus.)
14 ♂ 8 ♀, Santarem (do.)
4 ♂ 2 ♀, Rio Tapajoz (do.)

641. Attila bolivianus nattereri Hellmayr

Type locality: Borba, Rio Madeira
Pará (Natterer); Monte Alegre and Rio Jamundá, Faro (Snethlage)
2 ♂ 1 ♀, near Obidos
10 ♂ 2 ♀, Obidos (Carnegie Mus.)
6 ♂ 6 ♀, Santarem (do.)

642. Attila cinnamomeus cinnamomeus (Gmelin)

Type locality: Cayenne
Ipitinga (Hellmayr); Pará (Layard); Mexiana Island (Spix); Rio Inhangapy (Stone); Amapá (Goeldi); Itaituba (Hellmayr); Pará region, Marajo Island, Cussary, Rio Tapajoz, Rio Jary, Arumanduba, Monte Alegre, Rio Jamundá (Snethlage); Caviana Island (Brodkorb)
1 ♂, Rio Tapajoz, Pinhy
2 ♂, Obidos (Carnegie Mus.)
3 ♂ 2 ♀, Santarem (do.)
3 ♂, Rio Tapajoz, left bank (do.)

643. Casiornis rufa (Vieillot)

Type locality: Paraguay
Monte Alegre (Snethlage)

A campo species which is lacking in the Amazonian forests. Birds from this isolated locality on the north bank of the Amazon might prove separable.

644. Casiornis fusca Sclater and Salvin

Type locality: Bahia
Rio Muraitua (Stone); Pará, S. Antonio do Prata, Rio Tocantins, Rio Xingú, Rio Tapajoz (Snethlage)
1 ♀, Rio Tapajoz, Pinhy
1 ♂, Benevides (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)

645. Laniocera hypopyrrha (Vieillot)

Type locality:

Peixe-Boi and S. Antonio do Prata (Hellmayr); Pará (Stone); Pará region, Rio Tocantins, Rio Tapajoz, Rio Jary, Obidos (Snethlage); large series from both banks of the Amazon (Zimmer)

3 ♂ 2 ♀, Rio Tapajoz, east bank
9 ♂, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
3 ♂, Santarem (do.)
7 ♂, Rio Tapajoz, both banks (do.)

646. Rhytipterna simplex frederici (Bangs and Penard)

Type locality: Paramaribo, Surinam

Pará (Natterer); S. Antonio do Prata, Igarapé-Assu (Hellmayr); Santarem (Chapman and Riker; Hellmayr); Pará region, Rio Tocantins, Rio Tapajoz (Snethlage); Rio Jary, Obidos (Snethlage); Faro (Zimmer)

1 ♂, Pará, Bosque
1 ♂ 5 ♀, Rio Tapajoz, east bank
6 ♂ 3 ♀, Obidos (Carnegie Mus.)
2 ♀, Benevides (do.)
5 ♂ 6 ♀, Santarem (do.)

Our material brings out an interesting point in this connection. Mr. Zimmer has recently (1936) described the bird from the south bank as *intermedia* on very fine series. There would not appear, however, to be justifiable grounds for regarding our own as inadequate. Only four birds north of the Amazon out of thirty are appreciably paler and greyer, while only five from the south bank are noticeably yellower on the abdomen. Mr. Zimmer assigns all Amazonian birds to *intermedia*, but 12 specimens before us from the Rio Purus and Rio Solimoës appear instantly separable from Lower Amazon birds in being darker below. Thus we would not have described the birds from the south bank, and would most certainly have separated the others(!) were it not for the fact that Zimmer's material does not endorse it. If the two series were combined, the sensible course would probably be to follow Hellmayr in calling everything *frederici*.

647. Rhytipterna immunda (Sclater and Salvin)

Type locality: Oyapock, Cayenne, probably erroneous

1 ♂ from Santarem (Zimmer)

An exceedingly rare species, otherwise known from the Cassiquiare and the middle Rio Negro.

648. Lipaugus cineraceus (Vieillot)

Type locality: Cayenne
Numerous records throughout our area by all collectors
1 ♂, Rio Acará, Acará
18 ♂ 9 ♀, Rio Tapajoz, east bank
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂, Benevides(do.)
5 ♂ 2 ♀, Santarem (do.)

649. Pachyramphus viridis griseigularis Salvin & Godman

Type locality: Mt. Roraima, British Guiana
Marajo Island (Snethlage, 1926)
1 ♂ 1 ♀, Rio Tapajoz, Pataua, June 26 and 27, ♂ breeding

This species is almost unknown from the lower Amazon. Our pair are strikingly different from typical *viridis*, but agree minutely with Hellmayr's comparative critique of *griseigularis*. Needless to say, further material from the Amazon is required to settle the status of the local form there.

650. Pachyramphus surinamus (Linnæus)

Type locality: Surinam
Obidos (Hellmayr)
1 ♂, Obidos (Carnegie Mus.)

651. Pachyramphus rufus (Boddaert)

Type locality: Cayenne
Ubiquitous in our area, including Mexiana and Marajo Islands
2 ♂, near Obidos
4 ♂ 3 ♀, Rio Tapajos, east bank
2 ♂ 4 ♀, Obidos (Carnegie Mus.)
2 ♂ 3 ♀, Santarem (do.)
1 ♂ 2 ♀, Rio Tapajoz, left bank (do.)

652. Pachyramphus castaneus subsp.

Rio Tocantins, Baiao, 1 ♂ (Zimmer)
1 ♂, Rio Tapajoz, Caxiricatuba

For the status of these two specimens cf. Zimmer, Amer. Mus. Novit., no. 894, 1936, p. 8.

653. Pachyramphus castaneus amazonum Zimmer

Type locality: Rosarinho, Rio Madeira, Brazil
Rio Jamundá, Faro, Obidos, Monte Alegre (Snethlage); Monte Alegre (Zimmer)
1 ♂, Obidos
17 ♂ 15 ♀, (do.) (Carnegie Mus.)
3 ♂ 2 ♀, Santarem (do.)

654. Pachyramphus polychropterus tristis (Kaup)

Type locality: Cayenne
Mexiana Island (Sclater and Salvin); Marajo Island, and numerous localities north bank of Amazon from Obidos eastward (Snethlage and Zimmer)
2 ♂, near Obidos
6 ♂ 4 ♀, Obidos (Carnegie Mus.)

655. Pachyramphus polychopterus niger (Spix)

Type locality: Fonteboa, Amazonas
Villa Bella Imperatriz and Faro (Zimmer)

656. Pachyramphus polychopterus polychopterus (Vieillot)

Type locality: Bahia, Brazil
? Pará region (Sclater and Snethlage); Rio Tocantins (Snethlage and Zimmer) to the left bank of the Rio Tapajoz (Zimmer)
3 ♂ 4 ♀, Rio Tapajoz, east bank
1 ♀, Benevides (Carnegie Mus.)
9 ♂ 7 ♀, Santarem (do.)

An exceedingly variable series, one male from the Tapajoz very grey, others approaching *niger*, while most of the birds from the north bank are the blackest of all.(!) The three races listed here are a very unsatisfactory assemblage of variable intermediates in most of the range currently assigned to them, and are distinguishable only in very large series in the proportion of darker versus lighter birds.

657. Pachyramphus marginatus nanus Bangs and Penard

Type locality: Xeberos, Peruvian Amazon

Santarem (Chapman and Riker); Pará (Stone); Utinga (Beebe); numerous localities Rio Guamá, Pará region and all rivers on the south bank to the Rio Tapajoz, and various north bank localities (Snethlage)

1 ♀, Rio Tapajoz, Santarem
7 ♂ 9 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Benevides (do.)
2 ♂ 5 ♀, Santarem (do.)
12 ♂ 11 ♀, Rio Tapajoz, both banks (do.)

658. Platypsaris rufus rufus (Vieillot)

Type locality: Paraguay

Mocajuba, Rio Tocantins; Pará and Marajo Island (Zimmer)

The last two birds originally recorded by Snethlage as *minor*.

659. Platypsaris minor (Lesson)

Type locality: Cayenne

Pará (Natterer, and Stone); Santarem (Chapman and Riker); Ipitinga (Hellmayr); Pará region, Rio Tocantins and Rio Tapajoz (Snethlage); Obidos, Rio Tapajoz and Santarem (Hellmayr)

1 ♂ 1 ♀, Obidos (Carnegie Mus.)
6 ♂ 4 ♀, Santarem (do.)
1 ♀, Rio Tapajoz, Villa Braga (do.)

660. Tityra cayana cayana (Linnæus)

Type locality: Cayenne

Pará (Natterer, Wallace, Stone); Peixe-Boi, Ipitinga, S. Antonio do Prata, Igarapé-Assu (Hellmayr); Santarem (Chapman and Riker); Pará region, Rio Tocantins, and north bank localities (Snethlage); Marajo Island (Brodkorb)

1 ♀, Rio Acará, Acará
3 ♂ 3 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
2 ♂, Santarem (do.)

661. Tityra semifasciata semifasciata (Spix)

Type locality: Pará

Pará (Spix, Cabanis); Mexiana Island (Hagmann); Rio Muria (Natterer); Marajo Island, Rio Tocantins to Rio Tapajoz, and north bank localities (Snethlage); numerous localities throughout (Zimmer)

1 ♀, Rio Tapajoz, Tauary
2 ♂ 2 ♀, Obidos (Carnegie Mus.)
4 ♂ 1 ♀, Rio Tapajoz, both banks (do.)
11 ♂ 8 ♀, Santarem (do.)

It still remains to be determined how these two species divide the territory between them in places where they are both recorded.

662. Tityra inquisitor pelzelni Salvin and Godman

Type locality: Matto Grosso, Brazil

Peixe-Boi, S. Antonio do Prata (Hellmayr); Santarem (Chapman and Riker, Zimmer); Utinga (Beebe); Villa Bella Imperatriz (Zimmer)

1 ♀, Santarem (Carnegie Mus.)

663. Tityra inquisitor erythrogenys (Selby)

Type locality: corrected to Cayenne

Rio Jamundá, Faro (Snethlage and Zimmer)

This rare species has undoubtedly been overlooked in our area. The species should be sought on the left bank of the Rio Tapajoz, and such specimens might assist in solving the status of the unique *T. leucura* Pelzeln from the upper Rio Madeira, the characters of which suggest individual aberration. The greyer breast and upper parts, however, suggest the possibility of a local subspecies.

664. Haematoderus militaris (Shaw)

Type locality: Cayenne

Cametá, Rio Tocantins (Sclater and Salvin); Pará (Natterer); Igarapé-Assu (Hellmayr)

2 ♂ 2 ♀, Obidos (Carnegie Mus.)

An exceedingly rare bird, particularly in our area. It remains to be determined whether Amazonian specimens are the same as Guianian.

665. Querula purpurata (Müller)

Type locality: Cayenne

Ipitinga (Hellmayr); Rio Capim (Goeldi); Pará (Descourtilz, Natterer); Santarem (Chapman and Riker, Ihering); Castanhal (Stone); Rio Guamá, Pará region, Cussary (Snethlage)

2 ♂ 2 ♀, Pará, Bosque, and Val-de-Caes
1 ♂ 2 ♀, Rio Acará, Acará
1 ♂, Obidos (Carnegie Mus.)
3 ♂ 3 ♀, Benevides (do.)
2 ♂ 1 ♀, Santarem (do.)

666. Perissocephalus tricolor (Müller)

Type locality: Cayenne

Rio Jary, Monte Alegre (Snethlage)

3 ♂ 1 ♀, Obidos (Carnegie Mus.)

667. Gymnoderus foetidus (Linnæus)

Type locality: Surinam

Santarem (Chapman); Mexiana Island (Hagmann); Caviana Island (Brodkorb); Pará, Quati-puru, Monte Alegre (Snethlage)

1 ♀, Rio Tapajoz, Tauary
1 ♂ 2 ♀, Santarem (Carnegie Mus.)
1 ♀, Rio Tapajoz, Apaçy (do.)

Family PIPRIDAE

668. Piprites chloris chlorion (Cabanis)

Type locality: Cayenne

Utinga (Beebe); Quati-puru, Rio Guamá, Cussary, Rio Tapajoz, Rio Jary (Snethlage)

1 ♂ 1 ♀, Rio Tapajoz, Tauary
8 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)
3 ♂ 1 ♀, Rio Tapajoz, Mirituba (do.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

Still a rare bird in most collections, and Madame Snethlage reported a total of 7 specimens only from 7 localities. The species ranges widely, but is apparently unrecorded in much of upper Amazonia as yet.

669. Pipra aureola aureola (Linnæus)

Type locality: Surinam

Mexiana Island (Hellmayr); Caviana Island (Brodkorb); Marajo Island, Rio Moju, Maracá, Rio Jary, Arumanduba (?), Monte Alegre (?), Rio Maecuru (?), (Snethlage); Pará to Rio Xingú and Rio Jary (Zimmer)

670. Pipra aureola flavicollis Sclater

Type locality: Manaos

Obidos and Rio Jamundá, Faro (Snethlage); Faro, Monte Alegre and Villa Bella Imperatriz (Zimmer)

2 ♂, near Obidos

5 ♂ 2 ♀, Obidos (Carnegie Mus.)

671. Pipra aureola aurantiicollis Todd

Type locality: Santarem

Santarem (Chapman and Riker); Cussary, Tamucury (Snethlage); Rio Tapajoz, Santarem, Tamucury (Zimmer)

15 ♂ 7 ♀, Santarem (Carnegie Mus.)

The races of this species have a somewhat peculiar and unusual distribution in our area. The race *flavicollis* crosses the Amazon westward and occurs on the Rio Madeira. On the other hand, typical *aureola* occurs on the north bank and also the extreme eastern section on the south bank of the Amazon. Between this region and the Rio Madeira, the species is rare and local.

672. Pipra fasciicauda scarlatina Hellmayr

Type locality: São Paulo, Brazil

Rio Tocantins (Wallace, Snethlage and Zimmer); Itaituba, Rio Tapajoz (Hellmayr and Zimmer); Tapajoz, Jamauchim and Curuá rivers (Snethlage)

5 ♂ 4 ♀, Rio Tapajoz, both banks (Carnegie Mus.)

This species, closely related to the last and equally variable, is at the extreme northern limit of its range on the south bank of the Amazon, where it is apparently commoner than the last.

673. Pipra anomala Todd

Type locality: Santarem, Rio Tapajoz

This type is to date the only recorded specimen, and has been examined by us.

674. Pipra iris iris Schinz

Type locality: Pará, by subsequent designation
Ourem, Benevides, Igarapé-Assu, S. Antonio do Prata, Peixe-Boi (Hellmayr); Utinga, Santa Isabel and Castanhal (Stone); numerous localities near and east of Pará (Snethlage)
13 ♂ 4 ♀, Benevides (Carnegie Mus.)

675. Pipra iris eucephala Todd

Type locality: Mirituba, Rio Tapajoz
Santarem, Colonia do Mojuy (Todd)
2 ♂ 1 ♀, Rio Tapajoz, east bank
2 ♂ 2 ♀, (do.), Mirituba (Carnegie Mus.)
1 ♂ 3 ♀, Santarem (do.)

676. Pipra nattereri Sclater

Type locality: Borba, Rio Madeira
Left bank of Rio Tapajoz, Boim and Villa Braga (Snethlage)
26 ♂ 24 ♀, Rio Tapajoz, Villa Braga, (Carnegie Mus.)

Snethlage also records this species from the Rio Jamauchim, but the specimen is probably *iris eucephala*. These two species may prove to be conspecific.

677. Pipra erythrocephala erythrocephala (Linnæus)

Type locality: Surinam
Obidos (Hellmayr); north bank of Amazon, Rio Jary to Rio Jamundá (Snethlage)
1 ♂ 2 ♀, Obidos (Carnegie Mus.)

678. Pipra erythrocephala rubrocapilla Temminck

Type locality: Bahia
Bemfica, Marco de Legua, Nazaré, Rio Capim, Peixe-Boi, Ipitinga, S. Antonio do Prata (Hellmayr); Utinga (Beebe); various localities near Pará (Stone); throughout from Pará to left bank of Rio Tapajoz (Snethlage); Santarem (Chapman and Riker)
6 ♂, Pará, Bosque
2 ♂, Rio Acará, Acará
26 ♂ 16 ♀, Rio Tapajoz, east bank
16 ♂ 7 ♀, Benevides (Carnegie Mus.)
9 ♂ 6 ♀, Santarem (do.)
24 ♂ 11 ♀, Rio Tapajoz (both banks) (do.)

679. Pipra pipra pipra (Linnæus)

Type locality: Surinam
Rio Jary, Obidos, Rio Jamundá (Snethlage); Faro (Zimmer)
2 ♂, Obidos (Carnegie Mus.)

680. Pipra pipra separabilis Zimmer

Type locality: Tapará, Rio Xingú, Brazil
Pará (Wallace, Layard); Benevides, Maguary, S. Antonio do Prata, Igarapé-Assu, Peixe-Boi, Ipitinga (Hellmayr); Rio Capim (Goeldi); Ipitinga (Beebe); Castanhal (Stone); Pará region and Rio Tocantins (Snethlage); numerous localities, Pará to Rio Tapajoz (Zimmer)
4 ♂ 2 ♀, Pará, Bosque
2 ♂ 1 ♀, Rio Acará, Acará
4 ♂ 5 ♀, Benevides (Carnegie Mus.)

681. Machaeropterus pyrocephalus pyrocephalus (Sclater)

Type locality: probably eastern Peru; Ucayali, Upper Amazons by Berlepsch and Hartert.
Boim, Rio Tapajoz (Snethlage and Zimmer)
4 ♂ 3 ♀, Rio Tapajoz, Santarem, Tauary & Caxiricatuba
31 ♂ 11 ♀, Santarem (Carnegie Mus.)
5 ♂ 1 ♀, Rio Tapajoz, Apaçy (do.)

A rare species with a scattered distribution, suggesting that it still remains to be discovered in intervening areas.

682. Ceratopipra cornuta (Spix)

Type locality: forests of Amazon River
Obidos (Bates)

683. Tyranneutes virescens (Pelzeln)

Type locality: Manaos, Brazil
Obidos, Rio Jamundá (Snethlage)
27 ♂ 7 ♀, Obidos (Carnegie Mus.)

684. Tyranneutes stolzmanni (Hellmayr)

Type locality: Marabitanas, Rio Negro

Peixe-Boi (Hellmayr); Castanhal (Stone); Pará, Providencia, Ananindeua, Rio Tocantins, Cussary, Rio Jamauchim, and Rio Tapajoz (Snethlage)

1 ♂, Pará, Bosque
15 ♂ 1 ♀, Rio Tapajoz, various localities east bank.
6 ♂ 2 ♀, Benevides (Carnegie Mus.)
13 ♂ 7 ♀, Santarem (do.)
2 ♂ 1 ♀ 1 ?, Rio Tapajoz (do.)

685. Chiroxiphia pareola pareola (Linnæus)

Type locality: Brazil and Cayenne

Pará, S. Antonio do Prata, Ipitinga (Hellmayr); Santarem (Chapman and Riker); Obidos (Hellmayr); Capim and Inhangapy (Stone); large series, Pará to right bank of the Tapajoz, Marajo Island, Monte Alegre (Snethlage)

1 ♂, Rio Acará, Acará
39 ♂ 15 ♀, Rio Tapajoz, various localities, east bank.
1 ♂, Obidos (Carnegie Mus.)
6 ♂ 1 ♀, Benevides (do.)
8 ♂ 3 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Aveiros (do.)

686. Chiroxiphia pareola regina Sclater

Type locality: Borba, Rio Madeira

West bank of Rio Tapajoz, Boim and Villa Braga (Snethlage and Hellmayr)

4 ♂ 6 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

687. Manacus manacus manacus (Linnæus)

Type locality: Surinam

Monte Alegre, Obidos, Rio Jamundá (Snethlage); Faro and Monte Alegre (Zimmer)

1 ♂ 2 ♀, Obidos (Carnegie Mus.)

688. Manacus manacus purissimus Todd

Type locality: Benevides, Pará, Brazil

Numerous records by all collectors from the Pará region to the right bank of the Rio Tocantins (Baiao, fide Zimmer)

3 ♂ 1 ♀, Pará, Val-de-Caes
1 ♂ 1 ♀, Rio Acará, Acará
9 ♂ 4 ♀, Benevides (Carnegie Mus.)

689. Manacus manacus longibarbatus Zimmer

Type locality: Tapará, Rio Xingú, Brazil
Right bank of the Rio Xingú, and apparently also "Baião", Rio Tocantins, fide Zimmer

690. Manacus manacus purus Bangs

Type locality: Santarem, Rio Tapajoz
Numerous records by all collectors from the right bank of the Rio Tapajoz to Villa Bella Imperatriz, and the right bank of the Rio Madeira
7 ♂ 7 ♀, Rio Tapajoz, east bank
2 ♂ 7 ♀, Santarem (Carnegie Mus.)
3 ♂ 2 ♀, Rio Tapajoz (do.)

691. Neopipo cinnamomea cinnamomea (Lawrence)

Type locality: "Upper Amazon"
1 ♂, Rio Tapajoz, Villa Braga (Carnegie Mus.)

Previously unrecorded east of the left bank of the Rio Madeira

692. Schiffornis major Des Murs

Type locality: Sarayacu, Peru
Santarem (Hellmayr); Rio Jamundá, Faro (Snethlage)
1 ♂, Santarem
3 ♂, Obidos (Carnegie Mus.)
4 ♂ 2 ♀, Santarem (do.)

We prefer Zimmer's more conservative course in not recognizing the genus *Massornis*.

693. Schiffornis turdinus wallacii (Sclater and Salvin)

Type locality: Pará
Pará (Wallace, Stone); S. Antonio do Prata (Hellmayr); Pará to Rio Xingú on south bank, and north bank, Rio Jary to Rio Jamundá (Snethlage); numerous localities throughout (Zimmer)
2 ♂, Pará, Bosque
4 ♂ 2 ♀, Rio Tapajoz, various localities, east bank
3 ♂, Obidos (Carnegie Mus.)
6 ♂ 3 ♀, Benevides (do.)
8 ♂ 3 ♀, Santarem (do.)
4 ♂ 3 ♀, Rio Tapajoz, east bank (do.)

694. SCHIFFORNIS TURDINUS AMAZONUS (Sclater)

Type locality: Chamicuros, Peru

6 ♂ 2 ♀, Rio Tapajoz, Villa Braga

The material in the Carnegie Museum makes it clear that a final revision of the racial variation of this difficult species in upper Amazonian Brazil must be postponed until someone can assemble material from the entire area, without having to guess about the characters of series in other institutions. Mr. Zimmer's recent revision (Amer. Mus. Novit., no. 899, 1936, pp. 21–24) is, of course, quite the most authoritative, but he lacked Brazilian material west of the Rio Madeira. Mr. Todd's *intercedens* was based on a comparison of his Purus series with birds from east Ecuador, at that time passing as *amazonus*. Hellmayr guessed shrewdly and Zimmer proved that *intercedens* Todd = *amazonus* Sclater, and east Ecuador birds are a new race *aeneus* Zimmer. Seventeen specimens from the Rio Purus before us, presumably, therefore, representing *amazonus*, are strikingly distinct from *wallacii* in just the characters ascribed. On the right bank of the Tapajoz, occasional specimens show an approach to *amazonus*, but the series before us from the left bank (Villa Braga) is clearly inseparable from the Rio Purus series. We differ from Zimmer only in extending the range of *amazonus* eastward to the left bank of the Tapajoz. Mr. Zimmer has already commented that birds seen by him from the Rio Madeira "strongly suggest *amazonus*."

695. NEOPELMA PALLESCENS (Lafresnaye)

Type locality: Bahia

Rio Tapajoz, Santarem and Itaituba (Hellmayr); Serra de Paituna on north bank (Snethlage)

5 ♂ 1 ♀, Rio Tapajoz, Santarem

12 ♂ 2 ♀, Santarem (Carnegie Mus.)

The four species of Neopelma have a general range in eastern South America from the Guianas to southeastern Brazil. It is noteworthy that only one occurs rarely and locally in the lower Amazon, and on both banks at that. We have here an excellent illustration of a group whose range must have become disrupted by the Amazonian sea, and where the former gap in this range has not yet been filled in.

696. Heterocercus linteatus (Strickland)

Type locality: upper branches of Amazon River
Santarem (Chapman and Riker); Rio Iriri, Rio Jamauchim and Rio Tapajoz (Snethlage); various localities Rio Tapajoz (Zimmer)
14 ♂ 15 ♀, Rio Tapajoz, east bank
1 ♀, Santarem (Carnegie Mus.)
19 ♂ 5 ♀, Rio Tapajoz, both banks (do.)

697. Heterocercus flavivertex Pelzeln

Type locality: Marabitanas, Rio Negro
Rio Jamundá, Faro (Zimmer)

Snethlage records *H. linteatus* from Monte Alegre on the north bank of the Amazon. Either this locality is erroneous, or the specimen is *flavivertex*.

Family TYRANNIDAE

698. Xolmis cinerea (Vieillot)

Type locality: South America
Marajo Island (Allen and Snethlage); Caviana Island (Brodkorb); Rio Iriri (Snethlage)

A well known campos species, here at its northern limit.

699. Xolmis velata (Lichtenstein)

Type locality: São Paulo, Brazil
Mexiana Island (Wallace, Hagmann); Marajo Island (Allen, Hellmayr); Ereré, Rio Maecuru (Snethlage)
3 ♂ 1 ♀, South bank of Amazon, Lago Grande

This species is also at its extreme northern limit in our area, occurring only in unforested localities.

700. Colonia colonus colonus (Vieillot)

Type locality: Paraguay
1 ♂, Arary, Marajo Island (Brodkorb, 1937)

It is certainly remarkable that the only Amazonian specimen of this genus, although collected in 1871, was not recorded until 1937. The subspecies must be regarded as tentative only. The typical race is not otherwise known north of Maranhao (Zimmer, 1937), while *poecilonota* (Cabanis) is not reported outside of the Guianas.

701. Knipolegus orenocensis xinguensis Berlepsch

Type locality: Santa Julia, Rio Iriri, Rio Xingu

This species, apparently strictly riparian, is still rare in collections. The race *xinguensis* is still known only from the type collection, and two males from the Rio Araguaya, Goyaz, which Hellmayr refers here provisionally.

702. Knipolegus orenocensis sclateri Hellmayr

Type locality: Rio Madeira

2 ♂ imm., 2 ♀, Rio Tapajoz, Pinhy and Caxiricatuba

An equally rare bird, so far reported only from the type locality and Pebas, Peru. Our specimens are so dark and brown, that they cannot possibly be referred to *xinguensis*.

703. Phaeotriccus pœcilocercus (Pelzeln)

Type locality: Rio Amajau, Rio Negro

"Lower Amazon" (type of *Cnipolegus pusillus* in Brit. Mus.); Rio Tapajoz, Itaituba (Hellmayr); Rio Jamundá, Faro, Cussary, Monte Alegre, Rio Iriri, Rio Tocantins (Snethlage); numerous localities east to the Tocantins (Zimmer, 1937)

3 ♂ 1 ♀, Rio Tapajoz, west bank, Pinhel

4 ♂ ad. 1 ♂ imm., Rio Tapajoz, east bank, Pinhy and Caxiricatuba.

Another strictly riparian species, apparently much commoner than the *Knipolegus*. Both are recorded from the Orinoco as well as the Amazon.

704. Fluvicola pica albiventer (Spix)

Type locality: "Brazil"

Mexiana Island (Wallace); Marajo Island (Snethlage); Caviana Island (Brodkorb); Monte Alegre, Arumanduba, Rio Maecuru, Rio Iriri, Rio Tapajoz (Snethlage); Santarem (Chapman and Riker)

4 ♂ 2 ♀, north bank of Amazon near Obidos

4 ♂ 1 ♀, Obidos (Carnegie Mus.)

2 ♂ 1 ♀, Santarem (do.)

705. Arundinicola leucocephala (Linnæus)

Type locality: Surinam

Mexiana Island (Hagmann); Marajo Island (Hellmayr); Caviana Island (Brodkorb); Peixe-Boi, Quati-puru, Arumanduba, Monte Alegre, Cussary, (Snethlage); Santarem (Chapman and Riker)

3 ♂, north bank of Amazon near Obidos
3 ♂ 2 ♀, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Santarem (do.)

706. Pyrocephalus rubinus rubinus (Boddaert)

Type locality: "Amazon River"; see Brodkorb, 1937

Monte Alegre, Rio Xingú, Rio Iriri, Rio Curua (Snethlage)

1 ♂ 1 ♀, Santarem (Carnegie Mus.)

So far as we can see, typical *rubinus*, as currently restricted, still requires further study accurately to delimit its range. Brodkorb's work is certainly a step in the right direction.

707. Ochthornis littoralis (Pelzeln)

Type locality: Cachoeira, Rio Mamoré, Rio Madeira; Rio Jamauchim (Snethlage)

1 ♀, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

An upper Amazonian genus, only once reported east of the Rio Madeira.

708. Muscivora tyrannus tyrannus (Linnæus)

Type locality: Surinam

Pará region, Marajo and Mexiana Islands (numerous collectors); Caviana Island (Brodkorb); Monte Alegre and Rio Jamundá, Faro (Snethlage); Rio Tapajoz (various collectors); always reported as common where found. Pará, Rio Tapajoz, various localities, and Villa Bella Imperatriz, 15 specimens definitely this subspecies (Zimmer)

Zimmer's monographic study of this species (Amer. Mus. Novit. no. 962, Nov. 1937) proves that typical *tyrannus* is migratory, and occurs in our area from February to November. It is of course impossible to allocate the old records for the species in lower Amazonia, which are all given above.

709. Muscivora tyrannus circumdatus Zimmer, 1937

Type locality: Tauary, Rio Tapajoz, Brazil
Apparently resident on the south bank of the Amazon from Villa Bella Imperatriz to the right bank of the Tapajoz (Zimmer)
13 ♂ 4 ♀, Rio Tapajoz, various localities east bank (M.C.Z.)

710. Tyrannus albogularis Burmeister

Type locality: near Bahia and Pernambuco
Monte Alegre, 1 ♂ Aug. 9, 1908 (Snethlage); Santarem 1 ♂, July 25, 1883, (Chapman and Riker); Santarem, Rio Tapajoz and Villa Bella Imperatriz, 11 specimens, no dates (Zimmer)
1 ♂, south bank of Amazon, Lago Grande, Sept. 5
2 ♂ 1 ♀, Santarem, June 13, July 29, 1919 (Carnegie Mus.)

A characteristic campo bird of the interior of Brazil, apparently rare in our area. The recorded dates of capture of the known specimens, and the fact that Hellmayr has examined the bird from the north bank and found it identical with Matto Grosso specimens, raises the presumption that the species is partly migratory, and may occur in our area as a winter visitant only.

711. Tyrannus melancholicus melancholicus Vieillot

Type locality: Paraguay.
Villa Bella Imperatriz (Zimmer)

This Kingbird is at least partly migratory, and most of the birds from the south bank of the Amazon are unsatisfactory intermediates (cf. Zimmer, Amer. Mus. Novit. no. 962).

712. Tyrannus melancholicus despotes (Lichtenstein)

Type locality: Bahia
Common throughout the area (all collectors)
1 ♂ 1 ♀, Para, Bosque
23 ♂ 6 ♀, Rio Tapajoz, various localities, east bank
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Benevides (do.)
3 ♂ 2 ♀, Santarem (do.)
2 ♀, Rio Tapajoz, both banks (do.)

713. Empidonomus varius varius (Vieillot)

Type locality: Paraguay

Rio Tapajoz, Aramanay and Igarape Brabo, probably migrants (Zimmer, 1937)

714. Empidonomus varius rufinus (Spix)

Type locality: Amazon River

Common throughout the area, but unrecorded from Marajo and Mexiana Islands

2 ♂, Pará, Val-de-Caes
15 ♂ 3 ♀, 1 ?, Rio Tapajoz, east bank
3 ♂ 2 ♀, Benevides (Carnegie Mus.)
9 ♂ 5 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

715. Empidonomus aurantio-atro-cristatus minor (Hellmayr)

Type locality: São Luiz, Maranhao, Brazil

Santarem 1 ♂, (Snethlage); Santarem 2 ♂, (Zimmer)
6 ♂ 5 ♀, Rio Tapajoz, various localities, east bank
4 ♂ 1 ♀, Santarem (Carnegie Mus.)

This species illustrates how spotty our knowledge is of the status of many Amazonian birds. The good series collected by the Olallas could not have been predicted by the previous absence of records. There is apparently no reason why it should not occur in other parts of our area, and it is possibly a winter visitant only.

716. Legatus leucophaius leucophaius (Vieillot)

Type locality: Cayenne

Pará region (common); Marajo Island (Snethlage); Rio Tapajoz region (common); Obidos (Snethlage)

2 ♂, Pará, Bosque and Val-de-Caes
14 ♂ 3 ♀, Rio Tapajoz, Tauary and Pinhy
2 ♂, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Benevides (do.)
4 ♂, Santarem (do.)

As is usual in a good series in this species, one or two are notably larger than all the others.

717. Sirystes sibilator subcanescens Todd

Type locality: upper Rocaná, northern Pará, Brazil

Rio Jamundá, Faro, 1 ♀, (Snethlage); Rio Tocantins, Baião and Pedregal, and Rio Tapajoz, Limoàl (Zimmer)

2 ♂ 4 ♀, Obidos (Carnegie Mus.)

The type locality is only a few miles from the French Guiana border. Birds from the south bank of the Amazon might well be another subspecies, as Zimmer had no authentic specimens of *subcanescens*. This widely diffused and variable species is very rare in all parts of its range, except for the typical form in southeastern Brazil.

718. Myiodynastes maculatus maculatus (Müller)

Type locality: Cayenne

Cajutuba (Natterer); Mexiana Island (Hagmann); Caviana Island (Brodkorb); various north bank localities (Snethlage); Monte Alegre, Faro, and Villa Bella Imperatriz, (Zimmer)

1 ♂, Lago Jauary near Obidos

1 ♂ 2 ♀, Obidos (Carnegie Mus.)

2 ♂ 1 ♀, Santarem (do.)

The apparent absence of this species from most of the south bank of the Amazon is noteworthy.

719. Myiodynastes maculatus solitarius (Vieillot)

Type locality: Paraguay

Pará region (all authors); Rio Tocantins (Snethlage); Santarem (Chapman and Riker, Snethlage); Pará to Rio Tapajoz (Zimmer)

4 ♂ 10 ♀, 1 ? Rio Tapajoz, various localities, east bank.

1 ♀, Obidos (Carnegie Mus.)

5 ♂ 2 ♀, Santarem (do.)

Apparently a winter visitor only in our area. Zimmer reports intermediates from the Rio Xingú.

720. Megarynchus pitangua pitangua (Linnæus)

Type locality: eastern Brazil
Mexiana Island (Wallace); Rio Tocantins (Snethlage); Santarem (Chapman and Riker); Cussary, Rio Tapajoz, Rio Jamundá (Snethlage)
1 ♂ 1 ♀, near Obidos
4 ♂ 2 ♀ 1 ?, Rio Tapajoz, various localities, east bank
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
5 ♂ 2 ♀, Santarem (do.)
1 ♂ 3 ♀, Rio Tapajoz, left bank (do.)

721. Conopias trivirgata berlepschi Snethlage

Type locality: Rio Jamundá, Faro, 3 ♂
Faro, Rio Tapajoz, Caxiricatuba, Tauary, Igarapé Amorin (Zimmer)
1 ♂ 1 ♀, Boca do Igarapé-Piaba, near Obidos, March, 1933.
1 ♀, Rio Tapajoz, Pinhy, June 30, 1930
2 ♂ 1 ♀, islands near Obidos (Carnegie Mus.)
3 ♂, Obidos (do.)
5 ♂ 1 ♀, Santarem (do.)
3 ♂ 2 ♀, Rio Tapajoz, left bank (do.)

Obviously more widely ranging and less rare than formerly supposed.

722. Coryphotriccus parvus parvus (Pelzeln)

Type locality: Marabitanas, Rio Negro
5 ♂ 2 ♀, Obidos (Carnegie Mus.)

The first record for this rare genus in Amazonia.

723. Myiozetetes cayanensis cayanensis (Linnæus)

Type locality: Cayenne
Pará region (abundant); Mexiana Island (Hellmayr); Santarem (Chapman and Riker); Rio Mojú, Arumanduba (Snethlage)
2 ♂ 3 ♀, Pará, Bosque
13 ♂ 8 ♀, Rio Tapajoz, various localities
1 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
1 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

724. Myiozetetes similis similis (Spix)

Type locality: Amazon River; Rio Madeira as restricted by Zimmer.
Pará (Layard, Hellmayr); north shore of Amazon to Rio Jamundá (Snethlage); Villa Bella Imperatriz and Rio Tapajoz, Igarape Brabo (Zimmer)
1 ♂, Rio Tapajoz, Santarem
1 ♀, near Obidos
11 ♂ 5 ♀, Obidos (Carnegie Mus.)
8 ♂ 4 ♀, Santarem (do.)

Pará records may prove to be *pallidiventris* Pinto.

725. Tyrannopsis sulphurea (Spix)

Type locality: Brazil
Rio Muria (Natterer); Rio Inhangapy (Stone); Santarem (Chapman and Riker); Pará, Marajo Island, Amapá (Snethlage)
3 ♂, Rio Acará, Acará
2 ♂ 3 ♀, Santarem (Carnegie Mus.)

726. Pitangus sulphuratus sulphuratus (Linnæus)

Type locality: Cayenne
Abundant throghout the area (all collectors)
3 ♂ 2 ♀, Pará, Val-de-Caes
14 ♂ 12 ♀, Rio Tapajoz, various localities, east bank.
1 ♀, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
1 ♂, Santarem (do.)
2 ♂, Rio Tapajoz, left bank (do.)

While Hellmayr claims that *maximiliani* is a very unsatisfactory race, the ample material in the Museum of Comparative Zoology does not endorse this characterization. It is true that the average color differences are relatively slight, but there is a marked difference in wing length. In this respect our Amazonian series agrees with Cayenne material, the wings of all combined being nearly an inch shorter on the average than Bahia examples of *maximiliani*. We consequently quite definitely refer Pará birds to *sulphuratus*, and do not at all subscribe to Hellmayr's statement that they "might as well be referred to one race as the other".

727. Pitangus lictor lictor (Lichtenstein)

Type locality: Pará
Common, and recorded throughout our area
2 ♂ 3 ♀, near Obidos
5 ♂ 3 ♀ 2 juv., Rio Tapajoz, various localities, east bank
2 ♂, Obidos (Carnegie Mus.)
5 ♂ 4 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

728. Myarchus tyrannulus bahiae Berlepsch and Leverkühn

Type locality: Bahia
Rio Muria (Natterer); Santarem (Chapman and Riker); Monte Alegre (Snethlage); numerous localities in lower Amazonia (Todd); Rio Xingú, Rio Tapajoz, Rio Jamundá, Monte Alegre (Zimmer)
3 ♂ 1 ♀, Rio Tapajoz, various localities east bank
5 ♂ 2 ♀, Obidos (Carnegie Mus.)
9 ♂ 4 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, left bank (do.)

729. Myiarchus swainsoni pelzelni Berlepsch

Type locality: Bahia
Mexiana Island (Hellmayr, Snethlage, Zimmer); Marajo Island (Snethlage); Boim, Rio Tapajoz (Snethlage); Rio Xingú, Tapará (Zimmer)
1 ♂ 4 ♀, Rio Tapajoz, east bank
1 ♂ 3 ♀, Santarem (Carnegie Mus.)

730. Myiarchus swainsoni amazonus Zimmer, 1938

Type locality: Rio Jamundá, Faro, Brazil
Mexiana Island, (Hellmayr); Benevides, Santarem (Todd); Rio Tapajoz (Zimmer)
3 ♂ 2 ♀, Rio Tapajoz, east bank
1 ♀, Benevides (Carnegie Mus.)
3 ♂, Santarem (do.)

Typical *swainsoni* is to be expected in our area as a migrant.

731. Myiarchus ferox ferox (Gmelin)

Type locality: Cayenne
Throughout our area (Todd, Proc. Biol. Soc. Wash., **35**, 1922, p. 197, complete list of localities); Pará to Villa Bella Imperatriz (Zimmer)
12 ♂ 10 ♀ 1 ? , Rio Tapajoz, east bank
10 ♂ 12 ♀, Obidos, Benevides, Santarem, Rio Tapajos (Carnegie Mus.)

732. Myiarchus tuberculifer clarus Zimmer, 1938

Type locality: Tapará, Rio Xingú, Brazil
Whole north bank of Amazon (Snethlage); Rio Tapajoz (Todd, loc. cit., p. 211); Faro, Villa Bella Imperatriz (Zimmer)
2 ♂, Rio Tapajoz, Tauary and Pinhy
5 ♂, Obidos (Carnegie Mus.)
4 ♂ 1 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, left bank (do.)

733. Myiarchus tuberculifer subsp.

Pará, Igarape-Assu, 1 ♀, (Zimmer)
1 ♀, Benevides (Carnegie Mus.)

These specimens will probably prove to be *tricolor* Pelzeln, which is restricted by Zimmer to the coast region of eastern Brazil.

734. Contopus cinereus surinamensis Penard and Penard

Type locality: Surinam
Mexiana Island (Sclater and Hellmayr); Marajo Island (Hellmayr)

735. Empidonax lawrencei bolivianus Allen

Type locality: Yungas, Bolivia
Mexiana Island (Hellmayr); Rio Curuá (Snethlage); Rio Xingú, Tapará (Zimmer)
1 ♀, Boca do Igarape-Piaba, near Obidos
1 ♂, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
5 ♂ 3 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Miriituba (do.)

The Carnegie Museum has series of this bird from the Rio Purus and Rio Solimoës.

736. Empidonax euleri euleri (Cabanis)

Type locality: Cantagallo, Rio de Janeiro

Rio Capim, Rio Muraiteua (Stone); Rio Tocantins (Snethlage); Rio Tapajoz, Igarape Amorin (Zimmer)

1 ♀, Rio Tapajoz, Pinhy

1 ♀ imm., Santarem (Carnegie Mus.)

Presumably a winter migrant to our area.

737. Cnemotriccus fuscatus fumosus (Berlepsch)

Type locality: Cayenne

Arumanduba, Igarape de Paituna, Obidos, Marajo Island (Snethlage); Mexiana Island and Faro (Zimmer)

2 ♂ 1 ♀, Obidos (Carnegie Mus.)

2 ♂ 3 ♀, islands, Obidos (do.)

738. Cnemotriccus fuscatus fuscatior Chapman

Type locality: Rio Curaray, Ecuador

Rio Tapajoz, Goyana (Snethlage); Villa Bella Imperatriz to Rio Tocantins (Zimmer)

3 ♂ 1 ♀, Santarem (Carnegie Mus.)

3 ♂ 2 ♀ 1 ?, Rio Tapajoz, Goyana Island and left bank (do.)

We are unable to endorse Hellmayr's treatment of this difficult species in the Cat. Birds America, where he refers all birds south of the Amazon to *bimaculatus* (Lafresnaye & D'Orbigny) from Yungas, Bolivia, with the exception, of course, of typical *fuscatus* from southeastern Brazil. We have before us Bolivian topotypes of *bimaculatus*, and it is clear that this pale form ranges through the campo country of western Brazil north to the upper stretches of the Rio Purus and the Rio Madeira. A series (7 spec.) from the Rio Solimões is a very different dark race, slightly darker and browner above, and much darker and heavily flammulated with grayish olive on the chest, and yellowish rather than whitish on the belly. This is *fuscatior* Chapman of southeastern Ecuador, and it is clear that birds from Amazonian Peru probably belong here also, judging by Hellmayr's comments. We are quite unable to separate our lower Amazonian series from these birds. Proceeding northeastward, a fine series from Cayenne (21 specimens) represent *fumosus* (Berlepsch), which differs from *bimaculatus* in just the characters ascribed by Hellmayr. We agree that birds from Obidos

belong here, as do a series from the islands in the Amazon between Obidos and Santarem. All these birds are barely separable from *fuscatior* Chapman, which is a slightly darker bird on the average, although many specimens are interchangeable. We have here a most unsatisfactory distributional picture, undoubted *fuscatior* on the Rio Solimoës, undoubted *bimaculatus* on the upper Purus and the Rio Madeira, while from Villa Bella Imperatriz eastward occurs an admittedly variable and dimorphic population, perhaps nearer *fuscatior* than *fumosus*. A conservative position which chose to reduce *fuscatior* to the synonymy of *fumosus* could certainly be defended. Hellmayr's treatment was equally conservative, but modern series prove that birds from the south bank of the Amazon in our area most certainly cannot be referred to *bimaculatus*.

739. Terenotriccus erythrurus erythrurus (Cabanis)

Type locality: Guiana
Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)
2 ♂, Obidos (Carnegie Mus.)

740. Terenotriccus erythrurus hellmayri Snethlage

Type locality: Pará
The Pará region (all collectors) to the Rio Tocantins (Zimmer)
2 ♂ 1 ♀, Rio Acará, Acará
1 ♀, Benevides (Carnegie Mus.)

741. Terenotriccus erythrurus amazonus Zimmer, 1939

Type locality: Igarapé Amorin, Rio Tapajoz, Brazil
Santarem and Rio Tapajoz (all collectors); Villa Bella Imperatriz (Zimmer)
2 ♂, Rio Tapajoz, Caxiricatuba and Pinhy
1 ♂, Santarem (Carnegie Mus.)
14 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

742. Myiobius barbatus barbatus (Gmelin)

Type locality: Cayenne
Rio Jary and Obidos (Snethlage); Rio Jamundá, Faro (Zimmer)
3 ♂, Obidos (Carnegie Mus.)

743. Myiobius barbatus insignis Zimmer, 1939

Type locality: Piquiatuba, Rio Tapajoz, Brazil
Common throughout from Pará region to the Rio Tapajoz
3 ♂ 1 ♀, Rio Tapajoz, various localities east bank
1 ♀, Benevides (Carnegie Mus.)
2 ♂ 2 ♀, Santarem (do.)
5 ♂ 3 ♀, Rio Tapajoz, both banks (do.)

744. Myiobius atricaudus connectens Zimmer, 1939

Type locality: Mocajuba, Rio Tocantins, Brazil
Pará, Prata, Rio Tocantins, Rio Tapajoz, Rio Jamauchim (Zimmer)
2 ♂, Rio Tapajoz, Pinhy and Caxiricatuba

745. Myiophobus fasciatus flammiceps (Temminck)

Type locality: Rio de Janeiro
Pará (Sclater); Maguary and Mexiana Island (Snethlage)

746. Onychorhynchus coronatus coronatus (Müller)

Type locality: Cayenne
Common from Pará region to the Rio Tapajoz; Villa Bella Imperatriz and Faro (Zimmer)
1 ♀, Rio Acará, Acará
1 ♂ 1 ♀, Rio Tapajoz, Caxiricatuba
1 ♂ 3 ♀, Obidos (Carnegie Mus.)
1 ♂ 1 ♀, Benevides (do.)
1 ♂ 5 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz (do.)

747. Platyrinchus senex griseiceps Salvin

Type locality: Ourumee, British Guiana
Obidos (Snethlage)
12 ♂ 8 ♀, Obidos (Carnegie Mus.)

748. Platyrinchus senex amazonicus Berlepsch

Type locality: Peixe-Boi, Pará
Numerous records Pará region to Rio Tapajoz (Snethlage)
1 ♂ 2 ♀, Rio Tapajoz, Pinhy and Caxiricatuba
6 ♂ 3 ♀, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)
4 ♂ 1 ♀, Rio Tapajoz, both banks

749. Platyrinchus saturatus Salvin and Godman

Type locality: Merumé Mts., British Guiana
Peixe-Boi (Hellmayr); Pará (Stone); Rio Jamundá, Obidos, Rio Jary and Pará region (Snethlage); Faro, Obidos, Utinga (Zimmer)
3 ♂ 1 ♀, Obidos (Carnegie Mus.)
3 ♂ 3 ♀, Benevides (do.)
1 ♀, Santarem (do.)
1 ♀, Rio Tapajoz, Villa Braga (do.)

750. Platyrinchus coronatus coronatus Sclater

Type locality: Rio Napo, Ecuador
Rio Curuá, Rio Jamauchim (Snethlage); Rio Tapajoz, Caxiricatuba (Zimmer)
1 ♂, Rio Tapajoz, Caxiricatuba
5 ♂, (do.), Miriti tuba (Carnegie Mus.)

751. Platyrinchus coronatus gumia (Bangs and Penard)

Type locality: Paramaribo, Dutch Guiana
Rio Jary (Snethlage Hellmayr); Faro (Zimmer)

752. Tolmomyias sulphurescens mixtus Zimmer, 1939

Type locality: Baião, Rio Tocantins, Brazil

Known only from the type locality and one station in Maranhão.

753. Tolmomyias sulphurescens insignis Zimmer, 1939

Type locality: Rosarinho, Rio Madeira, Brazil
Rio Jamundá, Faro, Castanhal (Zimmer)

754. Tolmomyias flavotectus assimilis (Pelzeln)

Type locality: Borba, Rio Madeira
Rio Tapajoz, Igarapé Amorin, Igarapé Brabo (Zimmer)
1 ♂, Rio Tapajoz, Pataua

755. Tolmomyias flavotectus paraensis Zimmer

Type locality: Utinga, Pará, Brazil
Utinga and Cametá, Rio Tocantins (Zimmer)

756. Tolmomyias flavotectus examinatus (Chubb)

Type locality: Bartica Grove, British Guiana
Rio Jamundá, Faro, Castanhal (Zimmer)

Zimmer's study of this genus (Amer. Mus. Novit., no. 1045) proves that Amazonian records of *sulphurescens* really include races of *flavotectus*, a species previously unrecognized in South America east of the Andes. Unfortunately the genus is quite scarce in our area, and the few specimens examined by Zimmer inevitably leave large distributional gaps. It is of course impossible to allocate the earlier records without reexamination of the specimens. Snethlage reports "*assimilis* (Pelzeln) from the Pará region to the Rio Tapajoz. Birds from the Pará region might be either *sulphurescens mixtus* or *flavotectus paraensis*. The identity of birds from Santarem and the right bank of the Rio Tapajoz in the Carnegie Museum is problematical as Zimmer has been unable to examine a specimen of either species from there. No one knows where the subspecies *mixtus* and *insignis* of *sulphurescens* intergrade on the south bank of the Amazon. Equal uncertainty exists with the two races of *flavotectus*, and without comparative material, our one specimen from Pataua might be *paraensis*. The situation is almost as bad on the north bank. Faro is the only place from which both species are reported. The genus is recorded from the Rio Jary (Snethlage) and Obidos (Hellmayr). These birds might be *sulphurescens insignis* or *flavotectus examinatus*. On the other hand it is entirely in accord with the distribution of other widely ranging and variable species, that specimens from Obidos (and points further east) might indeed prove to be *sulphurescens cherriei* (Hartert and Goodson), as reported by Hellmayr.

757. Tolmomyias poliocephalus sclateri (Hellmayr)

Type locality: Manaos, Brazil
North bank localities (Snethlage), Pará region (numerous collectors) west to Rio Tapajoz (Snethlage); Faro and Pará to Villa Bella Imperatriz (Zimmer)

1 ♂ 2 ♀, Pará, Bosque
3 ♂ 4 ♀ 1 ? Rio Tapajoz, various localities, east bank
16 ♂ 10 ♀, Obidos, Santarem, Rio Tapajoz both banks (Carnegie Mus.)

758. Tolmomyias flaviventris dissors Zimmer, 1939

Type locality: Faro, Rio Jamundá, Brazil

Marajo Island, Rio Tocantins and Rio Tapajoz (Snethlage); Rio Tocantins to Villa Bella Imperatriz (Zimmer)

3 ♂ 2 ♀ 2 ?, Rio Tapajoz, various localities, east bank.

8 ♂ 2 ♀, Santarem (Carnegie Mus.)

It is certainly peculiar that this species is as yet undetected in the Pará region.

759. Tolmomyias flaviventris collingwoodi Chubb

Type locality: Trinidad

North bank localities (Snethlage); Monte Alegre (Zimmer)

1 ♀, near Obidos

6 ♂ 1 ♀, Obidos (Carnegie Mus.)

760. Rhynchocyclus olivaceus guianensis McConnell

Type locality: British Guiana

Throughout area from the Pará region westward on both banks (Hellmayr), Snethlage, Zimmer)

3 ♂ 4 ♀, Rio Tapajoz, various localities, east bank.

16 ♂ 5 ♀, Obidos, Benevides, Santarem, Rio Tapajoz (Carnegie Mus.)

761. Ramphotrigon ruficauda (Spix)

Type locality: Amazon River

Pará (Wallace); Rio Capim (Goeldi); Santarem (Riker); Rio Jamundá, Obidos, Rio Maecuru (Snethlage)

2 ♂, Pará, Bosque

4 ♂ 3 ♀, Rio Tapajoz, various localities, east bank

3 ♂ 3 ♀, Obidos (Carnegie Mus.)

2 ♂ 1 ♀, Benevides (do.)

5 ♂ 6 ♀, Santarem (do.)

2 ♂ 1 ♀, Rio Tapajoz, left bank

A fine series from the Solimoës (wing 73–80, average 75) is obviously a different subspecies from a series from Cayenne of similar size. The latter are paler and yellower below, less heavily flammulated with olive green. The Santarem and Tapajoz birds are intermediate. The Pará birds appear to be a little larger (wing 80–81), but a bigger series is required to confirm this. In color they resemble Rio Solimoës birds exactly.

762. Todirostrum chrysocrotaphum illigeri (Cabanis and Heine)

Type locality: Pará
Pará (Cabanis, Hellmayr, Snethlage, Stone); Rio Tocantins (Snethlage)
1 ♂, Santarem (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Itaituba and Villa Braga (do.)

The two birds from the left bank of the Rio Tapajoz[1] differ from *illigeri* in lacking the malar stripe, and have minutely less white on the throat, thereby approaching *chrysocrotaphum* (subsp.?), which is recorded from the Rio Madeira.

763. Todirostrum pictum Salvin

Type locality: Annai, British Guiana
Obidos (Snethlage)
3 ♂ 2 ♀ 1 ?, Obidos (Carnegie Mus.)

This series is obviously a different subspecies from another series from French Guiana, in being paler, less golden yellow below, much less heavily spotted, and streaked with black. However, there is no surety that French Guiana birds properly represent true *pictum* from British Guiana. Moreover, *guttatum* Pelzeln from the Rio Negro is almost certainly conspecific, and may or may not be properly represented by specimens from the Rio Solimoës.

764. Todirostrum cinereum cinereum (Linnæus)

Type locality: Surinam
Marajo Island (Hellmayr, Snethlage); Monte Alegre (Snethlage); Santarem (Chapman and Riker)
2 ♂ 2 ♀, Santarem
1 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)

This common and widely ranging species has a scattered distribution in our area, where the typical form is at its extreme southeastern limit. There are other races in Brazil south of the Amazon. Marajo Island birds might approach *cearae*.

[1] Since described as *similis* Zimmer, Amer. Mus. Novit., no. 1066, May 3, 1940, p. 3.

765. Todirostrum maculatum maculatum (Desmarest)

Type locality: French Guiana
Common on the north shore of the Amazon, Marajo and Mexiana Islands, and the Pará region west to the Rio Tocantins
1 ♂ 1 ♀, near Obidos
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
1 ♂ 1 ♀, Obidos (do.)

766. Todirostrum maculatum signatum Sclater and Salvin

Type locality: Nauta, Rio Marañon, Peru
Common from the Rio Xingú to the Rio Tapajoz
13 ♂ 4 ♀ 1 ?, Rio Tapajoz, various localities, east bank
5 ♂ 1 ♀, Santarem (Carnegie Mus.)
3 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

As Hellmayr has pointed out, birds from the Rio Tapajoz are transitional between true *maculatum* of the Guianas and *signatum* of upper Amazonia.[1] We agree that they are nearer *signatum*. Our series is notably shorter billed than a series from Surinam, averaging 2–3 mm. shorter. The two birds from near Obidos are intermediate in coloration, but have the longer bill of Surinam birds, so we refer them to typical *maculatum*.

767. Todirostrum latirostre senectum Griscom and Greenway, 1937.

Type locality: Obidos, Brazil
Santarem (Ihering), not given by Snethlage
1 ♂ 1 ♀, north bank of Amazon, Boca do Igarapé-Piaba near Obidos
5 ♂, Obidos (Carnegie Mus.)
5 ♂ 2 ♀, Santarem (do.)

Recent publications on this species have plunged this unfortunate little Tody-Tyrant into systematic confusion. Typical *latirostre* comes from Borba, Rio Madeira, and Dr. Hellmayr, the only student who has seen Pelzeln's type, has always stated that Bolivian, Matto Grosso (Chapada) and Rio Solimoës birds are typical, giving a distribution by no means exceptional. On this basis typical *latirostre* is are latively light colored and brownish headed bird, in spite of the fact that

[1] Since described as *diversum* Zimmer, Amer. Mus. Novit., no. 1066, 1940, p. 6.

Pelzeln described the type as "pileo plumbeo induto". There is no question about the very distinct *caniceps* Chapman, a much darker bird, with a dark grayish olive crown, and more yellow wash on the abdomen. Only two specimens are known from the type locality in eastern Colombia, and birds from various parts of Amazonian Ecuador may or may not properly represent it.

In May 1937, we described *senectum* from Obidos on the north bank of the Amazon, a considerable range extension of the species to the east. We had the advantage of examining the series in the Carnegie Museum first. *Senectum* is in general coloration intermediate between *latirostre* and *caniceps*, but most fortunately our notes, made at the time, state that Obidos birds are slightly grayer, less green above, wing bars and edgings paler, less rusty buff, below grayer on throat and chest, less yellow on flanks and belly than 18 specimens from the Rio Purus and Rio Solimoës. Compared with Matto Grosso specimens of *ochropterus* Allen, = typical *latirostre* fide Hellmayr, Obidos birds are greener above and slatier, less brownish on the pileum. Compared with east Ecuador specimens of *caniceps*, Obidos birds are not so dark above, the pileum is not quite so clearly slaty, with less extension of the gray on to the hindneck and mantle, while the underparts are much nearer *latirostre*.

We were somewhat surprised when in November, 1937, Mr. Todd described *difficile* from the Rio Purus and Rio Solimöes (south bank), his series amply confirming the differences noted by Hellmayr in two specimens from Teffe as compared with typical *latirostre*. But Mr. Todd (1) never mentioned *senectum*, (2) his description of *difficile* practically duplicates the characters ascribed to *senectum*, and (3) he states that Obidos birds are indistinguishable from *caniceps*, whereas we consider the same birds slightly paler than his *difficile*, which is paler than *caniceps!*

It is obviously high time for someone to compare these proposed subspecies with a real series from the Rio Madeira, and let us hope that the American Museum possesses one. This series may prove that Pelzeln had a slaty crowned bird after all, in which case the Matto Grosso birds will bear the name *ochropterus* (Allen), and it would remain to be determined how many races would prove recognizable in the Amazon Valley proper.[1]

[1] Zimmer (Amer. Mus. Novit., no. 1066, 1940) shows that *difficile* = *latirostre*, and recognizes *senectum*.

768. Todirostrum sylvia schulzi Berlepsch

Type locality: Ourem, Rio Guamá
Santa Isabel, San Antonio do Prata (Snethlage)
1 ♀, Benevides (Carnegie Mus.)

This species is as yet unrecorded between the upper Rio Branco and the localities listed above.

769. Euscarthmornis striaticollis griseiceps (Todd)

Type locality: Santarem, Rio Tapajoz
Santarem (Chapman and Riker, Snethlage and Hellmayr); Cussary (Snethlage)
6 ♂ 6 ♀ 1 ?, Rio Tapajoz, various localities, east bank
12 ♂ 5 ♀, Santarem (Carnegie Mus.)
1 ♀, Rio Tapajoz, Miriti tuba (do.)

An exceedingly local race known only from the Rio Tapajoz, right bank.

770. Euscarthmornis striaticollis iohannis (Snethlage)

Type locality: Monte Verde, Rio Purus
1 ♀, Rio Tapajoz, Villa Braga (Carnegie Mus.)

This specimen appears to agree very well with a series from the Rio Purus, and not with the type series of *griseiceps*.

771. Euscarthmornis griseipectus Snethlage

Type locality: Alcobaça, Rio Tocantins, 5 ♂
1 ♂, Santarem (Carnegie Mus.)

This rare species is otherwise recorded only from southeastern Peru! There are specimens from the Rio Purus in Pittsburgh.

772. Snethlagea minor (Snethlage)

Type locality: Arumatheua, Rio Tocantins
Also Rio Tapajoz, Villa Braga, Pinhel, Boim (Snethlage)
10 ♂ 4 ♀, Rio Tapajoz, Apaçy, Villa Braga and Itaituba (Carnegie Mus.)

773. Snethlagea minima minima Todd

Type locality: Itaituba, Rio Tapajoz
Also Rio Tocantins to Rio Madeira (Todd and Hellmayr)
1 ♂ 1 ♀, Rio Tapajoz, Tauary
4 ♂ 4 ♀, (do.), both banks (Carnegie Mus.)

The male from Tauary is a most unsatisfactory specimen. In color characters clearly *minima* and not *minor*. The wing length is 47 mm., which is too large for *minima*, but too small for males of *minor*. The tail is exactly the same length as in a male *minor* before us. In other words, this specimen is half way between these two supposed species, which appear very dubious to us, so we do not recognize *S. minor snethlageæ* H. Snethlage, 1937.

774. Taeniotriccus klagesi Todd

Type locality: Itaituba, left bank of Rio Tapajoz

Type examined by us. As Hellmayr points out, the unique type will probably prove to be the female of *T. andrei* Berlepsch and Hartert from the Caura River valley, Venezuela, only known from one immature male.

775. Lophotriccus vitiosus subsp.

Rio Jamundá, Faro; Obidos; Rio Jary (Snethlage)
2 ♂ 1 ♀, Obidos (Carnegie Mus.)

These birds are certainly not *eulophotes* Todd from the Rio Purus, but they can hardly be true *vitiosus* from "Peru".

776. Colopteryx galeatus (Boddaert)

Type locality: Cayenne
Common throughout our area (all collectors), except Marajo and Mexiana Islands
1 ♀, Rio Acará, Acará
13 ♂ 3 ♀, Rio Tapajoz, various localities, east bank
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂, Benevides (do.)
5 ♂, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, both banks

777. Perissotriccus ecaudatus ecaudatus (Lafresnaye and D'Orbigny)

Type locality: Yuracares, Bolivia

Peixe-Boi (Hellmayr); Santarem (Hellmayr); Pará region, Rio Tocantins, Rio Jamauchim, Rio Tapajoz, Rio Jary, Rio Jamundá (Snethlage)

3 ♂ 1 ♀, Rio Tapajoz, various localities, east bank
1 ♀, Obidos (Carnegie Mus.)
9 ♂ 7 ♀, Rio Tapajoz, left bank (do.)
1 ♂ 2 ♀, Santarem (do.)

Specimens from the north bank of the Amazon might prove referable to *miserabilis* Chubb from British Guiana, of which we have no comparative material.

778. Capsiempis flaveola flaveola (Lichtenstein)

Type locality: Bahia

Mexiana Island (Wallace, Hellmayr); Rio Tocantins, Rio Iriri, Rio Tapajoz, Rio Maecuru, Obidos, Rio Jamundá (Snethlage)

8 ♂ 3 ♀, Rio Tapajoz, various localities, east bank
10 ♂ 5 ♀, Obidos (Carnegie Mus.)

779. Stigmatura budytoides napensis Chapman

Type locality: Curary and Napo Rivers, Ecuador, Rio Tapajoz, Pinhel (Snethlage); Santarem (Hellmayr)

1 ♂ 1 ♀, Rio Tapajoz, east bank, Pinhy
3 ♂ 1 ♀, Rio Tapajoz, west bank, Pinhel

780. Serpophaga hypoleuca pallida Snethlage

Type locality: Alcobaça, Rio Tocantins

1 ♀, Lago Grande, west of Santarem
2 ♂ 1 ♀, Santarem (Carnegie Mus.)

We have no material for comparison. These specimens are distinctly browner above than 1 *hypoleuca* from east Ecuador, and are also a little larger (wing 51 mm.); in these two respects agreeing with the diagnosis of *pallida* from the Tocantins. They are not more purely white below, however. A distinct buffy tinge on the flanks may or may not be due to immaturity.

781. Inezia subflava subflava (Sclater and Salvin)

Type locality: "Pará"
Rio Tocantins to the Rio Tapajoz, both banks (Snethlage)
1 ♂ 3 ♀, Rio Tapajoz, various localities, east bank
5 ♂ 3 ♀, (do.) both banks (Carnegie Mus.)

782. Elainea flavogaster flavogaster (Thunberg)

Type locality: Rio de Janeiro
Apparently abundant throughout the region (all collectors)
1 ♂, Pará, Bosque
25 ♂ 4 ♀ 1 ?, Rio Tapajoz, various localities, east bank
1 ♀, Obidos
3 ♂ 4 ♀, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)

783. Elainea albiceps albiceps (Lafresnaye and D'Orbigny)

Type locality: Yungas, Bolivia
Arumatheua, Rio Tocantins (Snethlage)

784. Elainea parvirostris Pelzeln

Type locality: Borba, Rio Madeira
1 ♀, Rio Tapajoz, Santarem
1 ♂ 1 ♀, Santarem (Carnegie Mus.)

785. Elainea pelzelni Berlepsch

Type locality: Lamalonga, Rio Negro, Brazil
Monte Alegre, Rio Maecuru, Obidos (Snethlage)
1 ♀, Rio Tapajoz, Santarem
10 ♂ 6 ♀, Obidos (Carnegie Mus.)
6 ♂ 2 ♀, Santarem (do.)

A rare and little known species, easily recognized by its large size and brown coloration above. Previously unrecorded from the south bank of the Amazon.

786. Elainea cristata Pelzeln

Type locality: Goyaz, Brazil
Rio Tapajoz, Boim, and Monte Alegre (Snethlage)
1 ♂, Rio Tocantins, Cametá
2 ♂, 4 ♀, Rio Tapajoz, Santarem
2 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
6 ♂ 11 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz (do.)

787. Elainea chiriquensis albivertex Pelzeln

Type locality: Ypanema, Sao Paulo
Marajo Island, Rio Tocantins, Rio Tapajoz (Snethlage)
2 ♂ 6 ♀, Rio Tapajoz, various localities, east bank

788. Elainea gaimardii guianensis Berlepsch

Type locality: Camacusa, British Guiana
Peixe-Boi, San Antonio do Prata (Hellmayr); Rio Guamá (Stone); Pará region to right bank of Rio Tocantins, Obidos, and Rio Jamundá, Faro (Snethlage)
5 ♂ 2 ♀, Obidos (Carnegie Mus.)

789. Elainea gaimardii gaimardii (D'Orbigny)

Type locality: Yuracares, Bolivia
Left bank of Rio Tocantins to Rio Tapajoz (Snethlage)
11 ♂ 15 ♀, Rio Tapajoz, various localities, east bank
7 ♂ 8 ♀, Santarem (Carnegie Mus.)
5 ♂ 1 ♀, Rio Tapajoz, both banks

790. Elainea flavivertex Sclater

Type locality: Ucayali, Peru
Mexiana Island, (Hellmayr); Monte Alegre, Rio Jamundá, Faro (Snethlage)
1 ♂, near Obidos
3 ♂, Rio Tapajoz, Santarem
7 ♂ 3 ♀, Santarem (Carnegie Mus.)

791. Elainea viridicata viridicata (Vieillot)

Type locality: Paraguay
Boim, Rio Tapajoz (Snethlage)
1 ♂ juv., Rio Tapajoz, Santarem
7 ♂ 4 ♀, Santarem (Carnegie Mus.)

792. Suiriri affinis affinis (Burmeister)

Type locality: Lagoa Santa, Minas Geraes.
Serra de Ereré, near Monte Alegre, north bank of Amazon, 1 ♂ (Snethlage)

One of the characteristic campo species, little known in our area. It should be sought in the localities on the south bank, where this fauna occurs.

793. Sublegatus modestus obscurior Todd

Type locality: Cayenne
Mexiana Island (Wallace, Hagmann); Monte Alegre and Ereré (Snethlage); Pará (Stone)
4 ♂ 7 ♀, Obidos (Carnegie Mus.)

794. Sublegatus modestus modestus (Wied)

Type locality: Camamú, Brazil
1 ♂, Rio Tapajoz, Tauary
2 ♂, Santarem (Carnegie Mus.)

795. Phæomyias murina incompta (Cananis and Heine)

Type locality: Cartagena, Colombia
Monte Alegre (Snethlage)
5 ♂, Obidos (Carnegie Mus.)

796. Phæomyias murina murina (Spix)

Type locality: Brazil
Pará (Layard, Hellmayr, Stone); Mexiana Island Wallace, Hellmayr); Santarem (Hellmayr); Marajo Island (Hellmayr); Pará region, Rio Tocantins, Rio Tapajoz (Snethlage)
4 ♂ 8 ♀ 1 ?, Rio Tapajoz, various localities, east bank.
1 ♂, 3 ♀, (do.), both banks (Carnegie Mus.)
5 ♀, Santarem (do.)

797. Camptostoma obsoletum napæum Ridgway

Type locality: Diamantina, Santarem
Common throughout our area (all collectors)
3 ♂ 3 ♀, Rio Tapajoz, various localities, east bank
11 ♂ 13 ♀, Obidos, Benevides, Santarem, Rio Tapajoz (Carnegie Mus.)

798. Phyllomyias griseiceps (Sclater and Salvin)

Type locality: Babahoyo, Ecuador
3 ♂ 1 ♀, Obidos (Carnegie Mus.)

These birds and another from French Guiana have smaller bills than has a large series from Venezuela.

799. Tyranniscus acer Salvin and Godman

Type locality: Bartica Grove, British Guiana
Marajo Island (Snethlage); Caviana Island (Brodkorb); Pará (Layard); Peixe-Boi (Hellmayr); Pará region, Rio Tocantins, Rio Jamundá (Snethlage)
3 ♂, Pará, Val-de-Caes, and Bosque
5 ♂, Rio Tapajoz, various localities, east bank
1 ♂ 2 ♀, Obidos (Carnegie Mus.)
3 ♂, Benevides (do.)
11 ♂ 7 ♀, Santarem (do.)

800. Tyrannulus elatus elatus (Latham)

Type locality: Cayenne
Pará region (Spix, Hellmayr, Snethlage, Stone); Rio Tocantins and Rio Tapajoz (Snethlage); Santarem (Ihering, Chapman and Riker); Monte Alegre, Rio Jamundá, Faro (Snethlage)
2 ♂ 1 ♀, near Obidos
4 ♂ 4 ♀ 1 ?, Rio Tapajoz, various localities, east bank
17 ♂ 5 ♀, Obidos, Benevides, Santarem, Rio Tapajoz (Carnegie Mus.)

801. Ornithion inerme Hartlaub

Type locality: Bahia
Rio Guamá, Pará, Rio Tocantins (Snethlage); Rio Tapajoz (Hellmayr)
1 ♂ 2 ♀, Rio Tapajoz, Pinhy, Tauary, Caxiricatuba
1 ♂ 2 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
3 ♂, Rio Tapajoz, both banks (do.)

802. Pipromorpha oleaginea oleaginea (Lichtenstein)

Type locality: Bahia
Pará, San Antonio do Prata, Mexiana Island (Hellmayr)
1 ♂, Rio Tapajoz, Caxiricatuba
1 ♂ 4 ♀, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Benevides (do.)
6 ♂, Santarem (do.)
3 ♂ 2 ♀, Rio Tapajoz, left bank

803. Pipromorpha macconnelli macconnelli Chubb

Type locality: Camacabra Creek, British Guiana
2 ♂, Obidos (Carnegie Mus.)

804. Pipromorpha macconnelli amazona Todd

Type locality: Buenavista, Bolivia
Peixe-Boi, Benevides, Ourem (Hellmayr)
1 ♂ 1 ♀, Pará, Bosque and Val-de-Caes
2 ♂ 1 ♀, Rio Tapajoz, various localities, east bank
5 ♂, Benevides (Carnegie Mus.)
1 ♀, Santarem (do.)
11 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

All birds in the lower Amazon valley were called *oleaginea*, until Todd showed there were two species in 1921. Numerous old records, including many by Snethlage from throughout our area, cannot be allocated without reexamination.

Family OXYRUNCIDAE

805. Oxyruncus cristatus hypoglaucus (Salvin and Godman)

Type locality; Mt. Roraima, British Guiana
1 ♂ 1 ♀, Belem, Val-de-Caes

A notable range extension for this little known family of birds. Typical *cristatus* is the form of southeastern Brazil, and *hypoglaucus* was supposed to be confined to Mt. Roraima, of which we have a single topotypical male. Our male from Belem has the spotting below appreciably paler, but this degree of difference is covered by individual variation in other subspecies.

Family HIRUNDINIDAE

806. Progne subis subis (Linnæus)

Type locality: Hudson's Bay
Cussary and Rio Jamundá, Faro (Snethlage)
1 ♂, Rio Tapajoz, Goyana Island, Dec. 23, 1919, in (Carnegie Mus.)

Apparently the winter home of the Purple Martin is chiefly in northern and eastern Brazil, but there are still very few records.

807. Progne chalybea chalybea (Gmelin)

Type locality: Cayenne
The species is common throughout our area (nearly all collectors)
1 ♂ 1 ♀, north bank of Amazon, near Obidos
5 ♂ 3 ♀, 1 ?, Rio Tapajoz, east bank (approaching *domestica*)
1 ♀, Obidos (Carnegie Mus.)
1 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Goyana Island (do.)

The Tapajoz series is so perfectly intermediate that we list them separately as such. The birds are half way between the two races in size, and some of the males approach *domestica* in having whiter underparts, while others do not.

808. Progne chalybea domestica (Vieillot)

Type locality: Paraguay
1 ♂, Rio Acará, Villa Acará

The Acará specimen is typical *domestica* in coloration, but is a little smaller than southern birds. It is much larger, however, than Surinam specimens of *chalybea*. The facts are that the lower Amazon valley is occupied by variously intermediate birds, the majority of which are nearer to *chalybea* than *domestica*, and there is every possibility that *domestica* may be partly migratory also.

809. Phaeoprogne tapera tapera (Linnæus)

Type locality: Cayenne
Common throughout our area (Snethlage)
10 ♂ 3 ♀, Rio Tapajoz, various localities
1 ♀, Santarem, (Carnegie Mus.)
7 ♂ 6 ♀, Rio Tapajoz, Miriti-tuba (do.)

The southern race *fusca* (Vieillot) is migratory, and is recorded from parts of Amazonia, Venezuela and British Guiana. It should, consequently, be expected in our area.

[The North American *Petrochelidon pyrrhonota pyrrhonota* (Vieillot) should be expected in our area on migration.]

810. Stelgidopteryx ruficollis ruficollis (Vieillot)

Type locality: Rio de Janeiro, Brazil
Apparently common throughout our area (numerous collectors)

2 ♂, Pará, Val-de-Caes
4 ♀, Rio Tapajoz, east bank
2 ♂ 5 ♀, Benevides (Carnegie Mus.)
3 ♂ 1 ♀, Santarem (do.)
2 ♂ 3 ♀, Rio Tapajoz, both banks (do.)

811. Pygochelidon cyanoleuca cyanoleuca (Vieillot)

Type locality: Paraguay
1 ♀, Benevides, Sept. 13, 1918 (Carnegie Mus.)

Purely a migrant or winter visitant to our area.

812. Atticora fasciata (Gmelin)

Type locality: Cayenne
Rio Capim (Gmelin); Rio Capim and Cunany (Snethlage)

The wide range of this Swallow makes the lack of records in our area quite inexplicable, unless it is migratory.

813. Atticora melanoleuca (Wied)

Type locality: Rio Belmonte, Bahia, Brazil
Rio Tocantins, Rio Xingú, Rio Jamauchim (Snethlage)

814. Riparia riparia riparia (Linnæus)

Type locality: Sweden

7 ♂ 9 ♀, Lago Janary, near Obidos, March 16-18, 1933
1 ♂ 1 ♀, Obidos, March 23 and 25, 1921 (Carnegie Mus.)

Apparently previously overlooked in our area, where it is presumably a transient visitant on migration.

815. Hirundo rustica erythrogaster Boddaert

Type locality: Cayenne

One seen in February at Pará docks (Bond, in Stone); Pará, San Antonio do Prata, Marajo and Mexiana Islands, Rio Jamunda (Snethlage); Mexiana Island (Wallace, Hagmann); Santarem, March 1, 1889 (Chapman and Riker)

5 ♂ 7 ♀ 1 ?, north bank of Amazon, near Obidos, March 16, 1933
1 ♂ 4 ♀, Obidos, March 24-26, 1921 (Carnegie Mus.)
1 ♂, Santarem, March 25, 1919 (do.)
1 ♀, Rio Tapajoz, Itaituba, March 13, 1920 (do.)

There was obviously a heavy migration of North American swallows in March, 1933, the Bank Swallows having been taken at the same time. One of these Barn Swallows is inseparable from numerous European specimens of *rustica*.

816. Iridoprocne albiventer albiventer (Boddaert)

Type locality: Cayenne

Common throughout our area (all collectors)

8 ♂ 4 ♀, Rio Tapajoz, various localities, east bank
1 ♀, Obidos (Carnegie Mus.)
2 ♂, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Villa Braga (do.)

This series agrees with others from the Rio Tocantins and topotypes from Surinam in color. The wings of males from Surinam are 99–104 mm., from the lower Amazon 99–107 mm., and from southeastern Brazil 107–108 mm. Southern birds are progressively larger, but there is no color change. A fine adult male from Amazonian Ecuador has the wing 108 mm. It differs radically in color from eastern birds in having the head bluish green, the back green with no bluish tinge, and the tail with no steel blue reflections, the feathers dusky to hoary stone gray. Should further specimens confirm these differences and show a definite geographic range, there would be a perfectly valid subspecies, which would probably have to be called *aequatorialis* Lawrence, though we quite agree with Hellmayr (1935, p. 73, footnote) that the characters originally claimed have no validity whatever.

Family TROGLODYTIDAE

817. Heleodytes turdinus hypostictus (Gould)

Type locality: Rio Ucayali, Peru
Left bank, Rio Tapajoz (Snethlage)
1 ♀, Rio Tapajoz, Boim, wing 84 mm.

818. Heleodytes turdinus subsp.

Santarem (Chapman and Riker); Rio Xingú and Rio Tocantins (Snethlage)
1 ♀, Obidos (Carnegie Mus.)
13 ♂ 7 ♀, Santarem (do.)

Lack of topotypes from eastern Peru makes any final disposition of lower Amazonian birds impossible. While *hypostictus* in the aggregate differs from typical *turdinus* in more heavily spotted underparts, specimens are well known to be exceedingly variable. There is, however, a marked increase in size, the break occurring on the Rio Tapajoz. The table of wing measurements below brings this out clearly.

	♂	♀
11 Rio Solimoës	87–92	79–87
8 Rio Purus	85–88	82–83
1 Rio Tapajoz, Boim	——	84
1 Obidos	——	91
20 Santarem	91–97	88–91

In color characters, the large birds from Santarem agree with "*hypostictus*", but the female from Boim is in this respect indistinguishable from *turdinus*. The meager evidence before us suggests that adequate series covering the enormous range assigned to *hypostictus* will show the desirability of recognizing several subspecies differing in average characters.

819. Odontorchilus cinereus (Pelzeln)

Type locality: Salto de Girão, Rio Madeira
Rio Iriri, a tributary of the Rio Xingú (Snethlage); Rio Tapajoz, Miriituba and Colonia do Mojuy (2 ♀ in Carnegie Museum examined)

This very rare species is still known from only four specimens.

820. Thryothorus leucotis tæniopterus Ridgway

Type locality: Diamantina, Santarem, Brazil
Common throughout our area (all collectors); recorded from Marajo, but not Mexiana Island
2 ♂, near Obidos
8 ♂ 3 ♀, Rio Tapajoz, Tauary and Pinhy
5 ♂, Obidos (Carnegie Mus.)
9 ♂ 6 ♀, Santarem (do.)
4 ♂ 1 ♀, Rio Tapajoz, left bank (do.)

With 37 specimens before us of typical *albipectus*, and 38 specimens representing *tæniopterus*, we agree with Todd in recognizing the latter as a valid subspecies. While freely admitting the great amount of individual color variation in this species, these great series show conclusively that typical *albipectus* is more richly colored below, more cinnamomeous or tawny. There is also a marked size difference, which alone would entitle *tæniopterus* to recognition. Cayenne birds average 5–8 mm. longer wing, with a notably longer bill.

821. Thryothorus genibarbis genibarbis Swainson

Type locality: Bahia, Brazil
Throughout our area on the south bank of the Amazon from the Pará region to the Rio Tapajoz
6 ♂, Pará, Bosque, and Val-de-Caes
11 ♂, 11 ♀, Benevides (Carnegie Mus.)
8 ♂ 5 ♀, Rio Tapajoz (do.)

This variable species is widely spread south of the Amazon. The typical form is replaced by *juruanus* on the left bank of the Rio Madeira westward.

822. Thryothorus coraya coraya (Gmelin)

Type locality: Cayenne
Rio Jamundá, Obidos and Rio Jary (Snethlage)
6 ♂ 6 ♀, Obidos (Carnegie Mus.)

823. Thryothorus coraya herberti Ridgway

Type locality: Diamantina, Santarem
Abundant from the Rio Tocantins to the Rio Tapajoz
16 ♂ 13 ♀ 1 ?, Rio Tapajoz, various localities
4 ♂ 3 ♀, (do.), both banks (Carnegie Mus.)
17 ♂ 10 ♀, Santarem (do.)

The relationships between this species and *genibarbis* on the south bank of the Amazon are as yet unrecorded. The latter is abundant in the Pará region, and the present species unknown there, in spite of a wider geographic range.

824. Troglodytes musculus clarus Berlepsch and Hartert

Type locality: Bartica Grove, British Guiana
Common in clearings throughout our area (all collectors)
1 ♂, Pará, Bosque
4 ♂ 1 ?, Rio Tapajoz, various localities
2 ♂ 2 ♀, Lago Grande
3 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂ 3 ♀, Benevides (do.)
3 ♂ 3 ♀, Rio Tapajoz, Apaçy

The males from Pará are more richly colored than typical *clarus* and distinctly approach *musculus*, which ranges as far north as Ceará. So far as we can find, House Wrens from Maranhão have yet to be critically studied.

825. Microcerculus bambla bambla (Boddaert)

Type locality: Cayenne
2 ♂, Obidos (Carnegie Mus.)

This species is new to Brazil. The two adults are not separable from Cayenne topotypes.

826. Microcerculus marginatus marginatus (Sclater)

Type locality: "Bogota"
San Antonio do Prata and Peixe-Boi (Hellmayr); Pará region, various localities (Snethlage)
1 ♀, Rio Tapajoz, Tauary
7 ♂ 4 ♀, Benevides (Carnegie Mus.)
6 ♂, Santarem (do.)
5 ♂, Rio Tapajoz, Villa Braga, and Miriti tuba (do.)

Inseparable from 29 specimens from the Rio Purus and Rio Solimoës.

827. Leucolepis arada arada (Hermann)

Type locality: Cayenne
Obidos and Rio Jary (Snethlage)
11 ♂ 6 ♀, Obidos (Carnegie Mus.)

828. Leucolepis arada griseolateralis Ridgway

Type locality: Diamantina, Santarem, Brazil
Santarem (Chapman and Riker); Rio Jamauchim (Snethlage)
5 ♂ 3 ♀, Rio Tapajoz, Tauary, Caxiricatuba, Pataua
16 ♂ 15 ♀, Santarem (Carnegie Mus.)
9 ♂ 10 ♀, Rio Tapajoz, right bank (do.)

829. Leucolepis arada interposita Todd

Type locality: Villa Braga, left bank of Rio Tapajoz
Also Apaçy (Todd), west to the right bank of the Rio Madeira
12 ♂ 12 ♀, the type series in Carnegie Mus.

Family MIMIDAE

830. Mimus gilvus antelius Oberholser

Type locality: Bahia
Cajutuba (Natterer)

831. Mimus saturninus saturninus (Lichtenstein)

Type locality: Rio Tapajoz, Pará
Santarem (Allen, Riker and Chapman, Snethlage); Monte Alegre (Snethlage)

The rarity of this genus in lower Amazonia is just what would be expected of open country birds in a prevailingly forested area. *M. saturninus* is a common bird in the campo country south of our area and is currently called *frater* Hellmayr, but the validity of this race should be checked with an adequate series of typical *saturninus*.

832. Donacobius atricapillus atricapillus (Linnæus)

Type locality: eastern Brazil
Common on the north side of the Amazon, the Pará region, and Mexiana Island (all collectors); Santarem (Chapman and Riker); unrecorded from Marajo Island and anywhere else on the south bank between Pará and the Tapajoz
3 ♂ 2 ♀, near Obidos
1 ♂, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Santarem (do.)

Family TURDIDAE

833. Turdus phaeopygus poiteaui Bonaparte

Type locality: Cayenne
Obidos (Todd, as *cayennensis* Todd).
1 ♂ 4 ♀, Obidos (Carnegie Mus.)

834. Turdus phaeopygus coloratus Todd

Type locality: Colonia de Mojuy, Santarem.
Pará region, common (all collectors); Rio Acará Hellmayr); Rio Tocantins (Snethlage)
6 ♂ 1 ♀, Rio Tapajoz, east bank
1 ♂ 1 ♀, Benevides (Carnegie Mus.)
3 ♂ 3 ♀, Santarem (do.)

Whether *albicollis* and *phaeopyus* are conspecific or not is a matter of opinion. Mr. Todd (Proc. Biol. Soc. Wash., **44**, 1931, p. 51) considers specimens from the Pará region to be a third subspecies which he does not describe for lack of material, but these birds seem to us to be intermediate between the two races listed here, which appear very distinct.

835. Turdus nudigenis gymnophthalmus Cabanis

Type locality: Cayenne, designated by Berlepsch
Amapá, Rio Jamundá, Faro (Snethlage)

A fine series from Cayenne is easily separable from an equally fine series from Venezuela (typical *nudigenis*) in being darker, more umber brown on throat and chest below.

836. Turdus nudigenis extimus Todd

Type locality: Santarem, Brazil, Cussary (Snethlage)
3 ♂ 3 ♀, Santarem, (Carnegie Mus.)

There is disagreement between Messrs. Todd and Hellmayr on this species also. The former assigns all records from the Lower Amazon to *extimus*. The latter restricts *extimus* to the south bank without, however, even having seen any Amazonian specimens. As usual, the material in the Carnegie Museum fully endorses Mr. Todd's conclusions. The present subspecies is strikingly distinct.

837. Turdus fumigatus fumigatus (Lichtenstein)

Type locality: southeastern Brazil
Pará region common (all collectors); Caviana Island (Brodkorb); Mexiana Island (all collectors); Rio Tocantins (Snethlage); Santarem (Chapman and Riker)
3 ♂ 2 ♀, Rio Acará, Acará
2 ♂, Rio Tapajoz, Pinhy
1 ♂, Obidos (Carnegie Mus.)
1 ♂ 3 ♀, Santarem (do.)
2 ♂ 4 ♀, Rio Tapajoz, left bank (do.)

Replaced by *hauxwelli* Lawrence from the Rio Madeira westward.

838. Turdus amaurochalinus Cabanis

Type locality: Brazil
1 ♂, Pará (Snethlage)

This is a common thrush south of our area, ranging north along the coast of Maranhão. One wonders if the record from Pará is really authentic.

839. Turdus leucomelas ephippialis Sclater

Type locality: Bogatá
Amapá, Monte Alegre, Rio Jamundá (Snethlage)

840. Turdus leucomelas albiventer Spix

Type locality: Pará
Common, Mexiana, Marajo, Pará region (all collector); Caviana Island (Brodkorb); Rio Tapajoz (Snethlage)
1 ♂ 1 ♀, Pará, Bosque
11 ♂ 8 ♀, Rio Tapajoz, various localities
1 ♀, Benevides (Carnegie Mus.)
2 ♂ 3 ♀, Santarem (do.)

Family SYLVIIDÆ

841. Polioptila paraensis Todd, 1937

Type locality: Benevides, Pará, Brazil
1 ♂ nearly adult (possibly a ♀), type locality

This interesting little bird will probably prove to be related to the *guianensis-schistaceigula* complex when further specimens turn up. Above all, positively adult males are badly needed.

842. Polioptila plumbea plumbea (Gmelin)

Type locality: Surinam
Pará region (Hellmayr, Snethlage, Stone); Marajo Island (Hellmayr, Snethlage); Santarem (Hellmayr); Monte Alegre (Snethlage)
1 ♂, Pará, Val-de-Caes
3 ♂ 1 ♀, near Obidos
1 ♂, Rio Tapajoz, Pinhy
7 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
17 ♂ 9 ♀, Santarem (do.)

843. Ramphocaenus melanurus austerus Zimmer, 1937

Type locality: Pedral, Baião, Rio Tocantins, Brazil
Pará region, numerous records and localities (Sclater, Hellmayr, Snethlage, Stone); Rio Tocantins, east bank (Snethlage)
2 ♂, Benevides (Carnegie Mus.)

844. Ramphocaenus melanurus albiventris Sclater

Type locality: Surinam
Rio Jary, S. Antonio de Cachoeira (Snethlage); Faro (Zimmer)

845. Ramphocaenus melanurus amazonum Hellmayr

Type locality: Teffe, Rio Solimoës, Brazil
Common from the west bank of the Rio Tocantins westward (Snethlage, Zimmer)
25 ♂ 6 ♀, Rio Tapajoz, various localities, east bank.
10 ♂ 1 ♀, Santarem (Carnegie Mus.)
5 ♂ 3 ♀, Rio Tapajoz, both banks (do.)

Family MOTACILLIDAE

846. Anthus lutescens lutescens Pucheran

Type locality: Rio de Janeiro, Brazil
Pará (Snethlage, Stone); Benevides, Quati-puru (Snethlage); Mexiana Island (Wallace, Hellmayr); Marajo Island (Hellmayr, Snethlage); Rio Maecuru (Snethlage); Santarem (Chapman and Riker)
7 ♂ 7 ♀, Lago Grande, west of Rio Tapajoz
20 ♂ 8 ♀, Santarem (Carnegie Mus.)

Family CYCLARHIDAE

847. Cyclarhis gujanensis gujanensis (Gmelin)

Type locality: French Guiana

Pará region and entire area south of the Amazon to the Rio Tapajoz (numerous records, all collectors); Monte Alegre (Snethlage)

1 ♀, Pará, Bosque
7 ♂ 5 ♀, Rio Tapajoz, various localities, east bank.
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Benevides (do.)
2 ♂ 3 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, Aveiros, Miriti tuba (do.)

Family VIREOLANIIDAE

848. Smaragdolanius leucotis leucotis (Swainson)

Type locality: "Africa"

1 ♂, S. Antonio de Cachoeira, Rio Jary (Snethlage)

849. Smaragdolanius pulchellus simplex (Berlepsch)

Type locality: Santa Elena, Rio Jamauchim, Brazil.

Recorded only from the type locality, Boim on the Rio Tapajoz, and Arumatheua on the Rio Tocantins (Snethlage) in our area, and Barão Melgaço, northern Matto Gross (Naumburg)

2 ♂ 1 ♀, Santarem (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Bella Vista, Miriti tuba (do.)

There is as yet no record of this species between the Tapajoz and the Rio Purus. Five specimens from this river in the Carnegie Museum differ from *bolivianus* (1 spec.) in being brighter greener olive, the cap more bluish, less slaty gray with more of a greenish tinge forward, and the throat and breast appear a brighter more golden yellow.

Family VIREONIDAE

850. Vireo chivi chivi (Vieillot)

Type locality: Paraguay

Santarem and Miriti tuba, Rio Tapajoz (Todd)

2 ♀, Rio Tapajoz, Pinhy and Caxiricatuba, June and July
2 ♂, Santarem, April 30, and May 12, 1919. (Carnegie Mus.)
1 ♂, Rio Tapajoz, Miriti tuba, February 23, 1920 (do.)

A migrant to our area from the south.

851. Vireo chivi vividior Hellmayr and Seilern

Type locality: Caparo, Trinidad
Localities on the Rio Tapajoz (Todd)
1 ♂, Rio Tapajoz, Pinhy, March 5, 1933
1 ♀, Rio Tapajoz, Tauary, November 21, 1932

A migrant to our area from the north.

852. Vireo chivi solimoënsis Todd

Type locality: São Paulo de Olivença, Rio Solimoës
2 ♂, Pará, Val-de-Caes
27 ♂ 13 ♀, Rio Tapajoz, various localities, east bank
5 ♂ 7 ♀, Santarem (Carnegie Mus.)
5 ♂, Rio Tapajoz, both banks (do.)

There is hopeless disagreement at the moment on the proper treatment of this Vireo and its racial variation. (cf. Hellmayr, 1935, pp. 136–143, and Todd, Auk, 1931, pp. 407–412). Hellmayr and Zimmer claim that *chivi* is conspecific with the *virescens* group. Todd not only denies this, but divides *chivi* into two species, all the races of *chivi* from the Amazon Valley northward being a second species, the earliest name for which is *caucae*. Mr. Todd's position is based on very fine series of specimens of every proposed form, and the discovery of *chivi* and other northern subspecies at the same place and season in Amazonia. Hellmayr has fortunately examined some of these critical specimens, and while admitting the justification of Mr. Todd's identifications, suggests (1) that there is a higher degree of individual variation or (2) that the examples of *chivi* might be migrants. Mr. Todd's review leaves the resident bird (if any) of lower Amazonia unsettled, but Dr. Hellmayr maintains that all specimens seen by him east to Pará cannot be separated from *solimoënsis*.

The very large series before us throw some new light on these questions. The very great majority of the birds are *solimoënsis* both in color and size, and as these are the breeding birds, it is *solimoënsis* which is the resident race just as Dr. Hellmayr claims. On the other hand, seven specimens are readily picked out of this series by virtue of their much larger size. Two in their brighter and lighter green color are clearly *vividior*. Five others are strikingly grayer and duller, and are inseparable from typical specimens of *chivi*. These birds consequently endorse Todd's conclusions and also Dr. Hellmayr's admission that certain specimens are indeed strikingly like *chivi*. We disagree

most emphatically, however, in the identification of Todd's specimens of *vividior* from the Lower Amazon, and refer all of them to *solimoënsis*.

We see no occasion for adopting the extreme conclusions of either author. We cannot agree in reducing *chivi* to the *virescens* "formenkreis," but see no necessity for splitting *chivi* into two species for the reasons alleged above. Field experience has now overwhelmingly demonstrated that *flavoviridis* and *calidris*, the other two tropical species of this group, are highly migratory. It is, we think, a much more common sense position to regard *solimoënsis* as the resident race, to infer that *vividior* is migratory from the north, and *chivi* migratory from the south. The new evidence before us, on Mr. Todd's reasoning, would now require *chivi* to be split into *three instead of two* species, which seems to us a patent absurdity.

The type series of *griseola* Todd seems separable to us on the character claimed, though Hellmayr is doubtful if *griseola* and *solimoënsis* are really separable. He has also examined Todd's 2 Obidos specimens of *griseola* and cannot distinguish them from *solimoënsis;* neither can we.

Needless to say, it is quite impossible to allocate any of the older records and references subspecifically without reexamination. The species is recorded abundantly by all collectors from every part of our area except Marajo Island.

853. Vireo calidris barbatula (Cabanis)

Type locality: Cuba

1 ♀, Rio Tapajoz, Caxiricatuba, July 31, 1932
1 ♀, Obidos, January 20, 1921 (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga, December 10, 1919 (do.)

We wish to call attention to the surprising date of capture (July) of one specimen. It is in exceedingly worn and frowsy plumage, but is readily identified as *barbatula* rather than typical *calidris* by the much smaller bill. The color characters so obvious in fresh birds are completely obscured in this specimen, but it cannot be *barbadensis*, as the superciliary is buffy, not grayish.

Winter specimens of this West Indian vireo are exceedingly few. Recently collected specimens in American Museums from eastern Panama and the north coasts of Colombia and Venezuela have proved to be *barbatula*. There are a few older winter records from South America in European museums, but these specimens have never been critically determined subspecifically, with the single exception of

Natterer's specimen from Borba on the Rio Madeira, which Hellmayr shows is straight *calidris*. (Novit. Zool., 1910, p. 268). This, therefore, is the first definite record of *barbatula* from Brazil.

854. Hylophilus thoracicus griseiventris Berlepsch & Hartert

Type locality: Suapure, Caura River, Venezuela
Obidos (Hellmayr, 1935)
1 ♂, Obidos (Carnegie Mus.)

855. Hylophilus semicinereus semicinereus Sclater & Salvin

Type locality: Pará, Brazil
Common on the south bank of the Amazon from the Pará region westward (all collectors)
9 ♂ 11 ♀, Rio Tapajoz, various localities, east bank
5 ♂ 3 ♀, Benevides (Carnegie Mus.)
6 ♂, Rio Tapajoz, both banks, (do.)

856. Hylophilus semicinereus viridiceps (Todd)

Type locality: Pied Saut, French Guiana
Rio Jary, Obidos, Rio Jamundá (Snethlage and Todd)
4 ♂, Obidos (Carnegie Mus.)

857. Hylophilus pectoralis Sclater

Type locality: Villa Bella de Matto Grosso
Mexiana Island (Hagmann, Hellmayr); Marajo Island, Quati-puru, Rio Tocantins, Arumanduba, Monte Alegre (Snethlage)
1 ♂ 1 ♀, Rio Tapajoz, Santarem
5 ♂ 3 ♀, (do.) (do.) (Carnegie Mus.)

858. Hylophilus muscicapinus muscicapinus Sclater & Salvin

Type locality: Oyapock, French Guiana
Rio Jary and Obidos (Snethlage)
14 ♂ 3 ♀, Obidos (Carnegie Mus.)

859. Hylophilus muscicapinus griseifrons (Snethlage)

Type locality: Villa Braga, Rio Tapajoz
Otherwise known only from Boim (Snethlage), the Rio Madeira and northern Matto Grosso
6 ♂ 3 ♀, Rio Tapajoz, Villa Braga, and Apaçy (Carnegie Mus.)

860. Hylophilus brunneiceps inornatus (Snethlage)

Type locality: Cametá, Rio Tocantins
Also Rio Jamauchim (Snethlage) and Rio Tapajoz (Todd)
1 ♂, Rio Tapajoz, Caxiricatuba
4 ♂ 1 ♀, Santarem (Carnegie Mus.)
5 ♂ 2 ♀, Rio Tapajoz, Miriti tuba (do.)

861. Hylophilus hypoxanthus albigula (Chapman)

Type locality: Santa-Julia, Rio Iriri, Rio Xingú
Rio Xingú (Snethlage)

862. Hylophilus luteifrons Sclater

Type locality: Bartica Grove, British Guiana
San Antonio de Cachoeira, Rio Jary (Snethlage)
1 ♂, Obidos (Carnegie Mus.)

863. Hylophilus rubrifrons rubrifrons Sclater and Salvin

Type locality: Pará
Pará, (Natterer, Snethlage, Stone); other localities near Pará and Peixe- Boi (Snethlage)
3 ♂ 2 ♀, Benevides (Carnegie Mus.)

This race is probably restricted to the area east of the Rio Tocantins.

864. Hylophilus rubrifrons lutescens (Snethlage)

Type locality: Boim, Rio Tapajoz
Rio Xingú, Victoria and Rio Tapajoz, Villa Braga (Snethlage)
1 ♂ 1 ♀, Rio Tapajoz, Pataua and Tauary
6 ♂ 1 ♀, Rio Tapajoz, left bank (Carnegie Mus.)
9 ♂ 1 ♀, (do.) , right bank and Santarem (do.)

The series from the right bank of the Tapajoz is intermediate. Above, these birds are nearer *lutescens,* but they have the distinctly brownish throat and breast of *rubrifrons.*

Family COEREBIDAE

865. Chlorophanes spiza spiza (Linnæus)

Type locality: Surinam

Peixe-Boi (Hellmayr); Utinga (Beebe); Pará (Stone); Pará region, Rio Tocantins, Rio Jamauchim (Snethlage)

3 ♂, Pará, Bosque
4 ♂, Obidos (Carnegie Mus.)
6 ♂ 1 ♀, Benevides (do.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

866. Cyanerpes cyaneus cyaneus (Linnæus)

Type locality: Surinam

Pará region, abundant (all collectors); Rio Tocantins, Monte Alegre, Obidos (Snethlage)

21 ♂ 14 ♀, Rio Tapajoz, various localities, east bank
1 ♂ 2 ♀, Obidos (Carnegie Mus.)
3 ♂ 1 ♀, Benevides (do.)
5 ♂ 4 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz (do.)

867. Cyanerpes caeruleus caeruleus (Linnæus)

Type locality: Surinam

Common throughout our area (all collectors), but unrecorded from Marajo and Mexiana Islands

11 ♂ 5 ♀, Pará, Bosque, and Val-de-Caes
6 ♂, Benevides (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

868. Dacnis cayana cayana (Linnæus)

Type locality: Cayenne

Common almost throughout our area (all collectors), but as yet unrecorded from Mexiana Island, although collected on Marajo

1 ♂ 3 ♀, Pará, Bosque
21 ♂ 8 ♀, Rio Tapajoz, various localities, both banks
1 ♂, Obidos (Carnegie Mus.)
4 ♂ 1 ♀, Benevides (do.)
3 ♂ 4 ♀, Santarem (do.)
4 ♂ 2 ♀, Rio Tapajoz (do.)

869. Dacnis lineata lineata (Gmelin)

Type locality: Cayenne

Pará (Stone); Igarapé-Assu, Benevides (Hellmayr); Pará, Rio Acará (Snethlage)

1 ♂, Obidos (Carnegie Mus.)

This species is better known as *angelica* Bonaparte. It is certainly curious that it is unrecorded between Pará and the Rio Madeira.

870. Dacnis flaviventer Lafresnaye and D'Orbigny

Type locality: Yuracares, Bolivia

Rio Iriri, Rio Tapajoz, Rio Jamauchim (Snethlage)

1 ♂, label lost, but presumably Rio Tapajoz
1 ♂ 1 ♀, Santarem (Carnegie Mus.)
3 ♂ 1 ♀, Rio Tapajoz, Goyana Island, Apaçy (do.)

871. Coereba luteola chloropyga (Cabanis)

Type locality: Bahia

Maracá, Rio Jary, Monte Alegre, Rio Jamauchim (Snethlage) and Caviana Island (Brodkorb) all as *minima* Bonaparte from Cayenne; abundant throughout our area south of the Amazon (all collectors.)

7 ♂ 4 ♀, Pará, Bosque and Val-de-Caes
11 ♂ 7 ♀ 2 ?, Rio Tapajoz, various localities, east bank
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Benevides (do.)
1 ♂ 2 ♀, Santarem (do.)
3 ♂, Rio Tapajoz (do.)

This fine series averages slightly smaller and darker slate, less brownish above, than birds from eastern and southeastern Brazil. They thus slightly approach the Guiana race. As Hellmayr has duly noted, this bird is exceedingly variable individually, and we agree that there is really no need for more than two races in the area outlined above. It is merely unfortunate, as so often happens, that Bahia topotypes of *chloropyga* are not typical of the southern extreme. Obidos birds are inseparable, and show no approach to *minima*, to which Hellmayr assigns them.

872. Ateleodacnis speciosa speciosa (Temminck)

Type locality: Rio de Janeiro
Marajo Island (Snethlage), the northeastern limit

873. Ateleodacnis speciosa amazonum Hellmayr

Type locality: Tarapato, northern Peru
Ereré, Serra de Paituna, Rio Tocantins, Rio Tapajoz (Snethlage)
2 ♂ 1 ♀, Obidos (Carnegie Mus.)

Snethlage has recorded her birds as *Dacnis speciosa* and *D. analis* Lafr. and d'Orb. It remains to be determined whether some or all of these records really belong to *amazonum* or not.

874. Ateleodacnis bicolor bicolor (Vieillot)

Type locality; Cayenne
Cajutuba (Natterer); Mexiana Island (Hagmann); Pará, Marajo Island, Aqriqui, Arumanduba (Snethlage)
3 ♂ imm., near Obidos
5 ♂ 2 ♀, Obidos (Carnegie Mus.)
8 ♂ 4 ♀, Santarem (do.)

875. Ateleodacnis bicolor minor Hellmayr

Type locality: Rio Madeira, right bank below Rio Mahisi
Santarem (Chapman and Riker); Villa Bella Imperatriz (Zimmer)

Family COMPSOTHLYPIDAE

876. Dendroica aestiva aestiva (Gmelin)

Type locality: Canada
Chaves, Marajo Island, 1 ♂ (Snethlage)

877. Geothlypis aequinoctialis aequinoctialis (Gmelin)

Type locality: Cayenne
Pará, (Stone); Caviana Island (Brodkorb); Mexiana Island (Wallace, Hagmann, Hellmayr, Snethlage); S. Antonio do Prata and Rio Xingú (Snethlage)
3 ♂, Santarem (Carnegie Mus.)
2 ♂ 1 ?, Obidos (do.)

878. Granatellus pelzelni pelzelni Sclater

Type locality: Destacamento de Ribeirao, Rio Madeira
Santarem (Hellmayr); Rio Tocantins, Rio Tapajoz and Rio Jary (Snethlage).
4 ♂ 2 ♀, Rio Tapajoz, both banks
2 ♂ 2 ♀, (do.) , (do.) (Carnegie Mus.)
1 ♂, Santarem (do.)

879. Granatellus pelzelni paraensis Rothchild

Type locality: S. Antonio do Prata, Pará
Also Santa Maria de San Miguel, Rio Guamá (Snethlage)
1 ♀, Rio Acará, Acará

880. Basileuterus rivularis mesoleucus Sclater

Type locality: Demerara, British Guiana
Rio Muraiteua (Stone); Pará, Peixe-Boi, San Antonio do Prata (Snethlage); Rio Tapajoz, Villa Braga, and Colonia de Mojuy (Todd)
1 ♂ 1 ♀, Rio Tapajoz, east bank
1 ♀, Benevides (Carnegie Mus.)
1 ♂ 1 ♀, Santarem (do.)
1 ♂, Villa Braga (do.)

Family ICTERIDAE

881. Gymnostinops bifasciatus (Spix)

Type locality: Maranhao and Pará

Pará (Natterer, Spix, Snethlage); Peixe-Boi (Hellmayr); Arumatheua, Rio Tocantins (Snethlage)

1 ♂ ad., "Lower Amazons"

882. Gymnostinops neivæ Snethlage

Type locality: islands in Rio Iriri, a tributary on the west bank of the Rio Xingú

Santarem (Allen)

3 ♀, Santarem (Carnegie Mus.)

This remarkable bird is almost half way between the chestnut and blackish *bifasciatus* and the chestnut and yellow *yuracares*. Further specimens of this genus from the south bank of the Amazon are badly needed. Hellmayr has already commented on the greener, less yellow coloration of Rio Madeira specimens of *yuracares* which suggests the first step in an approach to *neivae*.

883. Ostinops decumanus decumanus (Pallas)

Type locality: Surinam

Rio Muria (Natterer); Rio Capim (Goeldi); Marajo Island, Amapá, Cunany, Rio Tocantins (Snethlage); Santarem (Chapman and Riker)

6 ♂ 2 ♀, Rio Tapajoz, east bank

1 ♀, Obidos (Carnegie Mus.)

1 ♂ 1 ♀, Santarem (do.)

There would seem to be a distinct decrease in size southward in eastern South America. Measuring only adult males and females, we get the following wing lengths—

Surinam	1 ♂ 141	4 ♀ 74-80
Rio Tapajoz	5 ♂ 124-133	2 ♀ 60-65
Bahia		1 ♀ 66

This difference could perhaps receive nomenclatural recognition were size not equally variable in other parts of the range of the species. Birds from upper Amazonian Brazil and east Ecuador are fully as large

as Surinam specimens. Birds from western Colombia and Panama, however, are small again like Brazilian birds, and there are no color differences if birds of similar age are compared. The youngest birds are more chestnut, less blackish above; the next stage, particularly in males, is dull blackish with a short crest, and only fully adult males are glossy black, with an elongated crest, and radically larger than females.

884. Ostinops viridis viridis (P. L. S. Müller)

Type locality: Cayenne

Pará (Natterer, Wallace, Layard); Caviana Island (Brodkorb); Peixe-Boi, San Antonio do Prata (Hellmayr); Rio Capim (Goeldi); Capanema, Rio Guamá, Rio Tocantins (Snethlage)

3 ♂, Rio Tapajoz, Boim
1 ♀, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

These birds are much nearer typical *viridis* than the very distinct *flavescens* Bangs and Penard of the Peruvian Amazons. They differ from a series from French and Dutch Guiana, however, in being distinctly yellower on throat and chest, thus showing a slight approach to *flavescens*.

885. Cacicus cela (Linnæus)

Type locality: Guiana

Common throughout our area (all collectors)

5 ♂ 5 ♂, Pará, Bosque and Val-de-Caes
2 ♂ 1 ♀, Rio Tocantins, Cameta
1 ♂ 1 ♀, Rio Xingú, Taparà and Porto do Moz
14 ♂ 11 ♀, Rio Tapajoz, east bank
1 ♂, Obidos (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Apaçy

886. Cacicus haemorrhous haemorrhous (Linnæus)

Type locality: Brazil in error, = Cayenne

Pará region, common (all collectors); no records from Marajo or Mexiana Islands; Villa Braga, Rio Tapajoz (Snethlage)

3 ♂ 2 ♀, Rio Tapajoz, Tauary and Boim
1 ♀, Benevides (Carnegie Mus.)
2 ♂, Santarem (do.)
7 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)

887. Archiplanus solitarius (Vieillot)

Type locality: Paraguay

Marajo Island (Snethlage); Caviana Island (Brodkorb); Arumanduba, Monte Alegre, Rio Jamundá (Snethlage); Santarem (Chapman and Riker)

2 ♂ 1 ♀, near Obidos
1 ♂, Rio Tapajoz, Santarem
7 ♂ 4 ♀, Santarem (Carnegie Mus.)

This Cacique occurs in our area, only where there is some open country. It will unquestionably be found locally elsewhere.

888. Psomocolax oryzivorus oryzivorus (Gmelin)

Type locality: Cayenne

Pará (Natterer, Wallace, Stone); S. Antonio do Prata, Ipitinga (Hellmayr); Rio Capim (Goeldi); Rio Guamá, and Monte Alegre (Snethlage); Santarem (Chapman and Riker)

4 ♂ 1 ♀, Rio Tapajoz, east bank
2 ♀, Santarem (Carnegie Mus.)

889. Molothrus bonariensis riparius Griscom and Greenway, 1937

Type locality: Pinhy, Rio Tapajoz, Brazil

Cajutuba (Natterer); Mexiana Island (Wallace); Marajo Island (Hellmayr); Quati-puru, Amapá, Monte Alegre, Cussary, Rio Tapajoz (Snethlage); Santarem (Pelzeln, Chapman and Riker, Hellmayr)

13 ♂ 3 ♀, Rio Tapajoz, various localities, east bank
1 ♀, Lago Grande, west of Rio Tapajoz
1 ♂, Obidos (Carnegie Mus.)
5 ♂ 3 ♀, Santarem (do.)
2 ♂ 1 ♀, Rio Tapajoz, Goyana Island (do.)

It seems to us clearly proved that lower Amazon Valley Cowbirds are neither typical *bonariensis* nor the dwarf *minimus* Delmas from Tobago, Trinidad, and the Guianas. Both these races have been ascribed to our area. The females are not dimorphic, apparently, as in *bonariensis*, and there are perfectly good size characters in addition, though *riparius* is intermediate in this respect.

890. Agelaius cyanopus Vieillot

Type locality: Paraguay

Arumanduba (Snethlage); the extreme northern limit

891. Agelaius icterocephalus icterocephalus (Linnæus)

Type locality: Cayenne
Amapá, Arumanduba, Monte Alegre, Marajo Island (Snethlage); Pará (Stone); Santarem (Chapman and Riker)
12 ♂ 8 ♀, Santarem (Carnegie Mus.)

892. Agelaius ruficapillus frontalis Vieillot

Type locality: Cayenne
Mexiana Island (Hagmann); Rio Guamá (Snethlage)

893. Leistes militaris militaris (Linnæus)

Type locality: Surinam
Common in marshes and open country throughout our area (all collectors).
8 ♂ 3 ♀, Rio Tapajoz, localities on both banks
2 ♂, Santarem (Carnegie Mus.)
1 ♂, Itaituba, Rio Tapajoz (do.)

894. Gymnomystax mexicanus (Linnæus)

Type locality: Cayenne
Recorded from practically all parts of our area, where marshes and open country occur
1 ♂ 2 ♀, Lago Grande
9 ♂ 4 ♀, Rio Tapajoz, both banks
1 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)

895. Sturnella magna subspecies

Savannahs of Rio Tocantins (Snethlage, 1926); Marajo Island (Brodkorb)

American ornithologists have generally overlooked Snethlage's record of the genus *Sturnella* ranging south to Lower Amazonia. She reported her birds as *meridionalis* Sclater, which is, of course, out of the question. On the other hand, Brodkorb identified his specimens as *praticola* Chubb of the lowlands of British Guiana, certainly the proper allocation until a series proves them separable. The completely isolated birds on the savannahs of the Tocantins might be something else again.

896. Icterus cayanensis cayanensis (Linnæus)

Type locality: Cayenne

Bemfica, Ipitinga, (Hellmayr); Castanhal (Stone); Pará and Marajo Island (Wallace); Pará, Providencia, San Antonio do Prata, Rio Tocantins (Snethlage)

1 ♂, Rio Tapajoz, Boim
1 ♂ 1 ♀, Rio Tapajoz, Santarem
1 ♀, Obidos (Carnegie Mus.)
1 ♂ 2 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Miriti tuba (do.)

897. Icterus croconotus croconotus (Wagler)

Type locality: Guiana

Monte Alegre, Rio Maecuru, Rio Jamunda (Snethlage); Santarem (Chapman and Riker)

2 ♂, Lago Grande
1 ♂, Rio Tapajoz, Santarem
2 ♀, near Obidos
3 ♂ 1 ♀, Obidos (Carnegie Mus.)
4 ♂ 4 ♀, Santarem (do.)

Family TERSINIDAE

898. Tersina viridis viridis (Illiger)

Type locality: Brazil

1 ♂ juv., Pará (Snethlage)

This record requires confirmation. The Swallow Tanager is otherwise unknown between the Rio Madeira (*occidentalis*) and the region between Bahia and Rio de Janeiro.

Family THRAUPIDAE

899. Tanagra musica intermedia (Chubb)

Type locality: Roraima, British Guiana

1 ♂ juv., Monte Alegre (Snethlage)

This is the species more familiarly known as *nigricollis* Sclater (*nec* Vieillot) or *cyanocephala* Vieillot (*nec* P.L.S. Müller). This blue-capped

species seems to have an interrupted distribution, the Lower Amazon Valley being one of the areas where it is almost wholly absent. South of our area the race *aurcata* (Vieillot) is common from southern Brazil southward. If the Antillean *musica* is not regarded as conspecific, the specific name of the South American bird is, of course, *aurcata*.

900. Tanagra chlorotica chlorotica (Linnæus)

Type locality: Cayenne

Marajo Island (Hellmayr, Snethlage); Rio Iriri, Rio Tapajoz (Snethlage); Santarem (Chapman and Riker); Rio Tapajoz, Itaituba (Hellmayr); Monte Alegre (Snethlage)

3 ♂ 4 ♀, Rio Tapajoz, east bank
8 ♂ 6 ♀, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)
4 ♂ 1 ♀, Rio Tapajoz (do.)

This species has a wide South American range, and is now divided into at least four races. All authors agree that the present one ranges south to the north bank of the Amazon valley. Southward we have the very poorly characterized *violaccicollis* (Cabanis), a group of variants too near *serrirostris* (Lafresnaye and d'Orbigny). It is still possible that the Amazon River may prove to be the best dividing line; in which case all specimens from the south bank would be called either *violaccicollis* or *serrirostris*, according to the author's taste in "splitting."

901. Tanagra xanthogaster subsp.

Rio Jamauchim (Snethlage).

2 ♂, Santarem (Carnegie Mus.)

Compare Hellmayr's remarks on Amazonian records of this species (Birds of Americas, pt. 1, Oct., 1936, p. 23, footnote).

902. Tanagra minuta mellea Bangs and Penard

Type locality: Iquitos, northeastern Peru

Souza (Hellmayr); Providencia, Rio Tocantins, Rio Tapajoz (Snethlage)

1 ♂, Rio Tapajoz, Caxiricatuba
4 ♂, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Benevides (do.)
1 ♂, Santarem (do.)
1 ♀, Rio Tapajoz, Aveiros (do.)

This species is widely distributed in northern South America and southern Central America, but is little known in the Amazon valley. Typical *minuta* has been recorded from Manaos; and Obidos birds might belong here too.

903. Tanagra violacea violacea (Linnæus)

Type locality: "Surinam"

Common throughout our area (all collectors), but not as yet recorded from Mexiana Island

2 ♂, Pará, Val-de-Caes
13 ♂, 4 ♀, Rio Tapajoz, both banks
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
4 ♂ 1 ♀, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz (do.)

904. Tanagra melanura (Sclater)

Type locality: Barra do Rio Negro, Brazil

1 ♂, near Obidos, and 1 ♂, do. (Carnegie Mus.)
4 ♂, Rio Tapajoz, east bank

Apparently not previously recorded east of the Rio Madeira.

905. Tanagra rufiventris rufiventris (Vieillot)

Type locality: Brazil

1 ♂, Boa Vista,Rio Xingú (Snethlage)
1 ♂, Rio Tapajoz, Villa Braga (Carnegie Mus.)

A species of upper Amazonia, otherwise unreported east of the Rio Madeira.

906. Tanagra cayennensis (Gmelin)

Type locality: Cayenne

Pará region, common (all collectors); Rio Jary (Snethlage)

1 ♂ 1 ♀, Pará, Bosque and Val-de-Caes
1 ♀, Rio Acará, Acará
1 ♂, Obidos (Carnegie Mus.)
3 ♂ 1 ♀, Benevides (do.)

This well known species reaches its extreme southern limit in northern Maranhão, just south of our area.

907. Tanagra chrysopasta subsp.

1 ♀, St. Antonio de Cachoeira, Rio Jary (Snethlage)
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

The two specimens from Obidos are minutely smaller than upper Amazonian birds, but show no suggestion of the very marked color characters of *nitida* Penard. It will be recalled that the type is the only definite record of this species in the Guianas. In the Carnegie Museum there is a male imm. from Pied Saut, French Guiana which also shows no real approach to *nitida*. It is apparent that *nitida* is one of the highly local coastal races in Surinam; this furnishes additional evidence that the "Guianas" are by no means an integral geographic unit. Typical *chrysopasta* is definitely recorded as far east as the Rio Madeira.

908. Tanagrella velia velia (Linnæus)

Type locality: Surinam
1 ♀, Obidos (Carnegie Mus.)

Not previously recorded so far south.

909. Tanagrella velia signata Hellmayr

Type locality: Pará
Pará (Layard, Hellmayr, Snethlage, Stone); Souza (Hellmayr); Providencia, Peixe-Boi, Rio Macryubim (Snethlage)
1 ♂ 1 ♀, Benevides (Carnegie Mus.)

This genus is lacking in Lower Amazonia between Pará and the Rio Purus, where *T. callophrys* has been collected.

910. Tangara chilensis chilensis (Vigors)

Type locality: Bolivia
2 ♂, Rio Tapajoz, Villa Braga (Carnegie Mus.)

The northeastern limit of this species, previously reported from Calamá, Rio Madeira.

911. Tangara punctata punctata (Linnæus)

Type locality: Surinam

Pará region, numerous localities (Hellmayr, Snethlage); Faro, Rio Jamundá (Snethlage)

3 ♀, Obidos (Carnegie Mus.)
2 ♂ 4 ♀, Benevides (do.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

912. Tangara varia (P.L.S. Müller)

Type locality: Cayenne

1 ♀, Villa Braga, and 1 ♂, Miriti tuba, Rio Tapajoz (Snethlage and Hellmayr)
1 ♀, Villa Braga (Carnegie Mus.)

A rare species, otherwise not reported authentically from our area.

913. Tangara cayana cayana (Linnæus)

Type locality: "Cajania"

Monte Alegre (Snethlage); Santarem (Chapman and Riker)

7 ♂ 3 ♀, 2 imm., Rio Tapajoz, Santarem
4 ♂ 12 ♀, Santarem (Carnegie Mus.)

We have elsewhere (1937) commented on the size variations of this species and the factor of *post mortem* color change.

914. Tangara cayana huberi (Hellmayr)

Type locality: Marajo Island

Only known from Marajo Island (Hellmayr, Snethlage).

915. Tangara gyrola albertinae (Pelzeln)

Type locality: Salto de Girao, Rio Madeira

Igarapé- Assu, S. Antonio do Prata (Hellmayr); Peixe-Boi, Rio Tocantins, Rio Jamauchim (Snethlage)

1 ♂ 1 ♀, Pará, Benevides (ex Carnegie Mus.)
2 ♂ 2 ♀, Benevides (Carnegie Mus.)

916. Tangara mexicana mexicana (Linnæus)

Type locality: Cayenne
Maracá and Monte Alegre (Snethlage)
2 ♂ 1 ♀, near Obidos
2 ♂ 2 ♀, (do.) (Carnegie Mus.)

917. Tangara mexicana lateralis Todd

Type locality: Rio Tapajoz, Apaçy
Common throughout the south side of the Amazon in our area, from the Pará region westward (all collectors)
12 ♂ 4 ♀, Rio Tapajoz, east bank
3 ♂, Benevides (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)
5 ♂ 2 ♀, Rio Tapajoz (do.)

We are at a loss to follow Hellmayr's strictures on this subspecies, which he synonymizes with *boliviana*. The 29 specimens in the type series of *lateralis* are readily told at a glance from 7 Bolivian skins.

918. Thraupis episcopus episcopus (Linnæus)

Type locality: Cayenne
Abundant throughout the area (all collectors)
1 ♂ 1 ♀, north bank of Amazon near Obidos
1 ♀, Pará Bosque
13 ♂ 7 ♀, Rio Tapajoz, east bank
1 ♂, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Benevides (do.)
3 ♂ 1 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Apaçy (do.)

This fine series differs from typical *episcopus* in having a larger and snowy white shoulder patch (rarely pale china blue), and a tendency to more extensive paler edgings to the wingcoverts, this slightly approaching *coelestis* (Spix) of upper Amazonia, which ranges east to the Rio Madeira.

919. Thraupis palmarum melanoptera (Sclater)

Type locality: eastern Peru

Common throughout the area (all collectors), except Marajo and Mexiana Islands; Caviana Island (Brodkorb)

1 ♂ 3 ♀, Pará, Bosque and Val-de-Caes
1 ♂, Rio Acará, Acará
9 ♂ 5 ♀, Rio Tapajoz, east bank
1 ♀, Obidos (Carnegie Mus.)
2 ♀, Benevides (do.)
7 ♂ 2 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Apaçy (do.)

This entire series is obviously nearer *melanoptera* than typical *palmarum*. We note, however, that Hellmayr refers "Pará" birds to *palmarum*.

920. Ramphocelus carbo carbo (Pallas)

Type locality: Surinam

Abundant throughout our area (all collectors)

4 ♂ ad., 3 ♂ imm., 1 ♀, Pará, Bosque and Val-de-Caes
18 ♂ ad., 6 ♂ imm., 9 ♀ ad., 8 ♀ imm., Rio Tapajoz, east bank.
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
1 ♂, Benevides (do.)
1 ♂, Santarem (do.)
4 ♂ 2 ♀, Rio Tapajoz (do.)

There is a rapid *post mortem* change in adult males of this species. Our fresh specimens are a brighter crimson on the throat and blacker on the abdomen than Guiana specimens, but old specimens from the Amazon are just like Guiana birds.

921. Ramphocelus nigrogularis subspecies

Monte Alegre, north bank, and Cussary, directly opposite on the south bank (Snethlage)

2 ♂, Obidos (Carnegie Mus.)
5 ♂ 2 ♀, Santarem (do.)

These nine specimens differ from nine topotypes from the Rio Solimoës in having the black abdominal patch more restricted, the sides and flanks consequently more extensively scarlet and often clearly separating the black thighs from the other black areas; under tailcoverts far

more extensively scarlet, the black tips much narrower; female with the abdominal patch more restricted also. In our opinion we have here an eastern subspecies worthy of recognition. Our agreement with the Carnegie Museum, however, does not permit us to describe their material, and Mr. Todd writes that he does not care "to take a chance" on this Tanager.

922. Piranga flava saira (Spix)

Type locality: Brazil = Caxias, Piauhy
Serra de Eréré, Monte Alegre (Snethlage); Santarem (Hellmayr)

According to Hellmayr (1929, p. 283), specimens from the north bank are nearer *saira*, and not *macconnelli* Chubb of British Guiana, as might have been expected.

923. Habia rubica peruviana Taczanowski

Type locality: Yurimaguas, Peru
Rio Tapajoz, Boim, Villa Braga (Snethlage)
5 ♂, Rio Tapajoz, Villa Braga, etc. (Carnegie Mus.)

It would appear that *peruviana* ranges east to the left bank of the Tapajoz. We cannot distinguish these birds from series from the Rio Purus and Rio Solimoës, and Dr. Hellmayr states that he cannot separate topotypes and birds from the Rio Madeira.

924. Habia rubica hesterna Griscom and Greenway, 1937

Type locality: Pataua, right bank, Rio Tapajoz
Santarem (Chapman and Riker); Rio Jamauchim (Snethlage)
1 ♂ 5 ♀, Rio Tapajoz, right bank

A paler bird below, with a pinker, less scarlet throat.

925. Lanio versicolor parvus Berlepsch

Type locality: Santa Elena, Rio Jamauchim
Rio Tocantins (Snethlage); Santarem (Chapman and Riker)
6 ♂ 2 ♀, Rio Tapajoz, various places east bank
1 ♂ , (do.) Miriti-tuba (Carnegie Mus.)
3 ♂ 1 ♀, Santarem (do.)

The males measure 76–80 mm. in wing length, the majority being 80 mm. Hellmayr records *versicolor* from the Rio Madeira on the basis of a male measuring 82 mm.

926. Lanio fulvus (Boddaert)

Type locality: Cayenne
St. Antonio de Cachoeira, Rio Jary
5 ♂ 1 ♀, Obidos (Carnegie Mus.)

927. Tachyphonus rufus (Boddaert)

Type locality: Cayenne
Pará region, common (all collectors); Rio Tocantins (Snethlage); Santarem (Chapman and Riker)
1 ♂ 3 ♀, Pará, Val-de-Caes
1 ♂ 2 ♀, Benevides (Carnegie Mus.)
1 ♂ 1 ♀, Rio Tapajoz, Miriti tuba (do.)

928. Tachyphonus luctuosus luctuosus Lafresnaye & D'Orbigny

Type locality: Guarayos, Bolivia
Throughout the south bank from the Rio Tapajoz to the Rio Tocantins (Chapman and Riker, Snethlage, Hellmayr); Rio Guamá (Snethlage); throughout the north bank in our area (Snethlage, Hellmayr)
13 ♂ 5 ♀, Santarem (Carnegie Mus.)
1 ♂ 2 ♀, Obidos (do.)
4 ♂ 5 ♀, Rio Tapajoz (do.)

929. Tachyphonus phoenicius Swainson

Type locality: East Peru
1 ♂, Boim, Rio Tapajoz (Snethlage)

930. Tachyphonus cristatus cristatus (Linnæus)

Type locality: "Cayania"
Rio Jamundá, Faro (Snethlage) and Obidos (Snethlage, Hellmayr)
4 ♂ 5 ♀, Obidos (Carnegie Mus.)

931. Tachyphonus cristatus brunneus (Spix)

Type locality: Rio de Janeiro
Common throughout our area on the south bank of the Amazon east of the Tapajoz (all collectors), but unrecorded from Mexiana Island
1 ♀, Pará, Val-de-Caes
2 ♂ 1 ♀, Rio Acará, Acará
1 ♂ 1 ♀, Santarem
11 ♂ 5 ♀, Rio Tapajoz, east bank
1 ♂ 2 ♀, Benevides (Carnegie Mus.)
8 ♂ 9 ♀, Santarem (do.)
5 ♂ 2 ♀, Rio Tapajoz, Villa Braga (do.)
1 ♂ , (do.) Miriti-tuba (do.)

Hellmayr in the Cat. Birds America, Pt. IX, thinks that *madeirae* Hellmayr of the Rio Madeira might extend east to the left bank of the Rio Tapajoz and west to the Rio Solimoës. While we have seen no material from the Rio Madeira, an unexpected situation develops. Birds from the left bank of the Rio Tapajoz are indistinguishable from Santarem and Pará series. Twelve specimens from the Rio Purus and the Rio Solimoës are also absolutely inseparable from Lower Amazon birds and not a single one displays any of the characters ascribed to *madeirae*.

932. Tachyphonus surinamus surinamus (Linnæus)

Type locality: Surinam
1 ♂, Obidos (Snethlage)

This form ranges west to Manaos, and is replaced further west by *brevipes* Lafresnaye (= *napensis* Lawrence).

933. Tachyphonus surinamus insignis Hellmayr

Type locality: Bemfica, Pará
Pará region, common (all collectors); Rio Tocantins (Snethlage)
2 ♂ 2 ♀, Pará, Bosque
1 ♂ 1 ♀, Santarem
9 ♂ 4 ♀, Rio Tapajoz, east bank
4 ♂ 3 ♀, Benevides (Carnegie Mus.)
3 ♂ 2 ♀, Santarem (do.)
4 ♂ 1 ♀, Rio Tapajoz, both banks (do.)

This race ranges west to the Rio Madeira.

934. Eucometis penicillata penicillata (Spix)

Type locality: Brazil
Pará region, common (numerous collectors); Mexiana Island (Wallace, Hagmann); Rio Tocantins, Cussary, Rio Jamundá (Snethlage)
1 ♀, near Obidos
1 ♂, Obidos (Carnegie Mus.)
2 ♂, Santarem (do.)
1 ♀, Benevides (do.)

Series from Cayenne and two birds from Obidos do not differ in either color or size from series from the Rio Solimoës and Rio Purus, the wing of males being 85–90; Santarem specimens, 89–91, 95; Benevides, 1 ♀ 95. It will be apparent, therefore, that birds near the city of Pará may prove to be a large local race.

935. Nemosia pileata pileata (Boddaert)

Type locality: Cayenne; Not Pará (Sclater and Salvin), fide Hellmayr
Mexiana Island (Wallace, Hagmann, Hellmayr); Marajo Island (Hellmayr, Snethlage); Cajutuba (Natterer); Rio Tocantins, Arumanduba, Monte Alegre, Eréré (Snethlage)
1 ♂ 1 ♀, Rio Tapajoz, Pinhy
3 ♂ 3 ♀, Obidos (Carnegie Mus.)
2 ♂ 1 ♀, Santarem (do.)

936. Hemithraupis guira guira (Linnæus)

Type locality: northeastern Brazil = Pernambuco
Caviana Island (Brodkorb); Pará and Rio Capim (Stone); Pará, Rio Moju, Rio Tocantins (Snethlage)
3 ♂ 2 ♀, Pará, Val-de-Caes
1 ♂, Rio Tapajoz, Caxiricatuba
5 ♂ 2 ♀, Santarem (Carnegie Mus.)
2 ♂ 1 ♀, Rio Tapajoz, Miriti tuba (do.)

Not previously recorded west of the Tocantins. Series from the Rio Purus and Rio Solimoës in the Carnegie Museum are also *guira*.

937. Hemithraupis guira nigrigula (Boddaert)

Type locality: Cayenne
Arumanduba, Rio Maecuru, Rio Jamundá, Faro (Snethlage)
3 ♂, Obidos (Carnegie Mus.)

938. Hemithraupis flavicollis flavicollis (Vieillot)

Type locality: Cayenne
3 ♂ 6 ♀, Obidos (Carnegie Mus.)

For so widely distributed a bird, its absence from most of the Lower Amazon seems curious. The race *centralis* (Hellmayr) is recorded from the Rio Madeira.

939. Lamprospiza melanoleuca (Vieillot)

Type locality: Guiana
Pará (Natterer); Igarapé-Assu, Ipitinga, Benevides (Hellmayr); Pará region, Rio Tapajoz, Rio Jamundá, Faro (Snethlage); Santarem (Chapman and Riker)
2 ♂ 1 ♀, Pará, Bosque
2 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Benevides (do.)
6 ♂ 2 ♀, Santarem (do.)
3 ♂ 2 ♀, Rio Tapajoz, left bank (do.)

This genus is as yet unreported in Amazonia west of our area.

940. Cissopis leveriana leveriana (Gmelin)

Type locality: Cayenne
2 ♂, Rio Tapajoz, Itaituba (Carnegie Mus.)

941. Schistochlamys melanopis melanopis (Latham)

Type locality: Cayenne
Santa Isabel (Snethlage; Santarem (Berlepsch)
1 ♂, Pará, Val-de-Caes
5 ♂ 2 ♀, 4 imm., Rio Tapajoz, Santarem
6 ♂ 3 ♀, Benevides (Carnegie Mus.)
13 ♂, Santarem (do.)

These birds show no approach whatever to the alleged characters of *olivina* Sclater. It is quite remarkable that this widely diffused species is practically unrecorded in our area.

Family FRINGILLIDAE

942. Cyanocompsa cyanoides rothschildii (Bartlett)

Type locality: Carimang River, British Guiana
Pará region, common (all collectors); Rio Tocantins (Snethlage); Santarem (Chapman and Riker); Rio Jary, Monte Alegre (Snethlage)

3 ♀, Rio Acará, Acará
2 ♂ 1 ♀, Rio Tapajoz, east bank
1 ♂, Obidos (Carnegie Mus.)
3 ♂ 2 ♀, Benevides (do.)
4 ♂, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz (do.)

943. Oryzoborus angolensis torridus (Scopoli)

Type locality: unknown; north coast of Venezuela by Hellmayr
Pará (Wallace, Snethlage, Stone); Mexiana Island (Hellmayr, Snethlage); Rio Tocantins, Cussary, Rio Tapajoz (Snethlage); Rio Jamundá, Faro (Snethlage)

9 ♂ 11 ♀, Rio Tapajoz, various localities, east bank.
1 ♂ 1 ♀, Obidos (Carnegie Mus.)
2 ♂ 2 ♀, Benevides (do.)
1 ♂ 1 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Miriti tuba (do.)

944. Oryzoborus crassirostris crassirostris (Gmelin)

Type locality: Guiana
Mexiana Island (Hagmann, Snethlage); ? Cussary (Snethlage)

945. Sporophila schistacea longipennis Chubb

Type locality: Mt. Roraima, British Guiana
Peixe-Boi, Snethlage (Snethlage, as *S. grisea*)

This form is as yet unrecorded between the type locality and Pará.

946. Sporophila leucoptera mexianae Hellmayr

Type locality: Mexiana Island
Mexiana Island (Hagmann, Hellmayr, Snethlage)

A local race of a species widely distributed south of our area.

[SPOROPHILA LEUCOPTERA CINEREOLA (Temminck)

Type locality: Bahia
Pará, by Graham (Sharpe, in Cat. Birds Brit. Mus.)

There is a probable error of labelling here, this race, the old *S. hypoleuca* (Licht.), not being definitely known north of Maranhão.]

947. SPOROPHILA PLUMBEA WHITELEYANA (Sharpe)

Type locality: Mt. Roraima, British Guiana
Mexiana Island (Hagmann, Hellmayr, Snethlage); Marajo Island (Hellmayr)

948. SPOROPHILA CASTANEIVENTRIS CASTANEIVENTRIS Cabanis

Type locality: Guiana
Obidos (Hellmayr); Arumanduba, Monte Alegre (Snethlage)
1 ♂ 1 ♀, Obidos (Hellmayr)

949. SPOROPHILA CASTANEIVENTRIS ROSTRATA Todd

Type locality: Santarem, Brazil
Rio Tapajoz (Snethlage); Santarem (Chapman and Riker, Hellmayr)
2 ♂, Rio Tapajoz, Pinhy and Caxiricatuba.
12 ♂ 3 ♀, Santarem (Carnegie Mus.)
1 ♂, Rio Tapajoz, Goyana Island (do.)

950. SPOROPHILA MINUTA MINUTA (Linnæus)

Type locality: Surinam
Nazaré, (Layard); Mexiana Island (Hagmann); Marajo Island (Snethlage); Santarem (Chapman and Riker); Quati-puru, Maracá (Snethlage) Rio Tocantins (Snethlage);
1 ♂ , Rio Tapajoz, Tauary
2 ♂ 1 ♀, Santarem (Carnegie Mus.)

951. SPOROPHILA BOUVREUIL BOUVREUIL (Müller)

Type locality: Bahia, Brazil
Mexiana Island (Hagmann); Marajo Island (Snethlage)

The extreme northern limit for this well known east Brazilian species.

952. Sporophila americana americana (Gmelin)

Type locality: Cayenne

Pará (Wallace, Spix); Mexiana Island (Wallace, Hellmayr); Pará region, numerous localities, Marajo Island, Rio Tocantins, and whole of north shore (Snethlage); Santarem (Chapman and Riker)

5 ♂ 2 ♀, near Obidos
4 ♂ 2 ♀, Obidos (Carnegie Mus.)
1 ♀, Benevides (do.)
3 ♂ 3 ♀, Santarem (do.)

The alleged racial variation of this species in our area seems most inconsistent and unsatisfactory. A fine series from Cayenne proves a great deal of individual variation in color. Entirely apart from wear, the amount of white in the wing of males is quite variable. Females are astonishingly variable. Older birds are apparently darker and more richly colored, while younger ones are much paler and grayer, especially below. Size seems quite constant, the wing of males 56–58, ♀ 54–56. The series from Santarem and Obidos were described as *dispar* Todd. All five females are pale and grayish brown below, but not distinguishable from Cayenne birds in similar plumage. The males have more white in the wing than the majority of Cayenne males, but no more than those with the maximum amount of white from Cayenne. These birds are minutely larger, wing of ♂ 59–61, ♀ 56–59. The single female from Benevides is as richly colored as any ♀ from Cayenne, the wing 55. Finally a series from the Solimoës is inseparable from Cayenne topotypes. Hellmayr has pointed out that *leucopterygia* Spix is available for Amazon birds, but the type locality is Pará. Our own view is that the absence of dark females from Obidos and Santarem is a pure accident of small series, that the remaining differences are inconsistent and trifling, and that all birds from Lower Amazonia can be called *americana*.

953. Sporophila caerulescens caerulescens (Vieillot)

Type locality: Brazil

1 ♂, Sta. Julia, Rio Iriri (Snethlage)
1 ♂, Rio Tapajoz, Pinhy

Our single male is notably paler gray above, with less blackish on the pileum, thus agreeing with Hellmayr's comments on the Rio Iriri specimen. The Lower Amazon birds are isolated, and will probably prove separable, when a proper revision of the species can be attempted.

954. Sporophila nigricollis nigricollis (Vieillot)

Type locality: Brazil
Pará region, numerous records, (most collectors); Ilha das Oncas, Mexiana Island, Monte Alegre, Rio Tocantins (Snethlage)

955. Sporophila lineola (Linnæus)

Type locality: Surinam
Pará region to Rio Tapajoz (Snethlage); Urucurituba, Santarem (Hellmayr).
10 ♂ 2 ♀, Rio Tapajoz, various localities, east bank
1 ♀, Pará, Bosque
1 ♂, Santarem, (Carnegie Mus.)
1 ♂, Rio Tapajoz, Villa Braga (do.)

956. Sporophila bouvronides (Lesson)

Type locality: Trinidad
North side of River Amazon and Mexiana Island (Wallace, *fide* Sharpe in Cat. Birds Brit. Mus., as *S. amazonica* Sharpe); Obidos (Snethlage)
3 ♂ 2 ♀, Obidos (Carnegie Mus.)

Hellmayr regards *S. ocellata, S. trinitatis* Sharpe and *S. amazonica* Sharpe as synonyms of *bouvronides*. We agree that there is a good chance that this species will prove to be a mutation of *lineola*.

957. Volatinia jacarina jacarina (Linnæus)

Type locality: northeastern Brazil
Common throughout our area (all collectors)
5 ♂ 1 ♀, Pará, Bosque
1 ♀, Rio Acará, Acará
4 ♂ 1 ♀, Rio Tapajoz, east bank
2 ♂ 1 ♀, Benevides (Carnegie Mus.)
1 ♂, Santarem (do.)
1 ♂ imm., Rio Tapajoz, Itaituba (do.)

958. Pitylus grossus grossus (Linnæus)

Type locality: Cayenne
Pará region, common; Rio Tocantins, Rio Xingú, Rio Tapajoz. Rio Jamauchim, Rio Jary (Snethlage)

1 ♀, Pará, Val-de-Caes
1 ♂, Rio Acará, Acará
7 ♂ 2 ♀, Rio Tapajoz, various localities, east bank.
1 ♂, Obidos (Carnegis Mus.)
1 ♀, Benevides (do.)
4 ♂ 4 ♀, Santarem (do.)
8 ♂ 2 ♀, Rio Tapajoz, both banks

959. Periporphyrus erythromelas (Gmelin)

Type locality: Cayenne
Pará region, common (all collectors)

1 ♂, Rio Tapajoz, Caxiricatuba
1 ♂, Benevides (Carnegie Mus.)

This Grosbeak has been overlooked on the north bank of the Amazon in our area. Its occurrence on the Rio Tapajoz is a slight extension in its extreme southern range.

960. Caryothraustes canadensis canadensis (Linnæus)

Type locality: Cayenne
Pará region, common (all collectors); Rio Tocantins (Snethlage)

5 ♂ 1 ♀, Pará, Val-de-Caes and Bosque
4 ♂, Benevides (Carnegie Mus.)

The distributional features of these two Grosbeaks in our area are practically identical.

961. Saltator maximus maximus (P.L.S. Müller)

Type locality: Cayenne
Common throughout our area (all collectors), but unrecorded from Mexiana and Marajo Islands

6 ♂ 3 ♀ 2 ?, Pará, Val-de-Caes
1 ?, Rio Tocantins, Cametá
16 ♂ 11 ♀, Rio Tapajoz, various localities
2 ♀, Obidos (Carnegie Mus.)
2 ♂ 3 ♀, Benevides (do.)
4 ♂ 2 ♀, Santarem (do.)
2 ♂ 2 ♀, Rio Tapajoz, both banks (do.)

962. Saltator caerulescens mutus Sclater

Type locality: Mexiana Island

Pará region (Snethlage and Stone); Mexiana Island (Wallace, Hagmann, Hellmayr); Marajo Island (Snethlage); Rio Tocantins, Rio Jamauchim and north shore localities (Snethlage)

4 ♂ 1 ♀, south bank of Amazon, Lago Grande
3 ♂ 1 ♀, Obidos (Carnegie Mus.)
3 ♂ 1 ♀, Santarem (do.)
1 ♂ 1 ♀, Rio Tapajoz, Itaituba (do.)

The specimens from Santarem and the Rio Tapajoz may or may not properly represent *mutus* of Mexiana Island. This race is replaced by *azaræ* from the Rio Madeira westward, by typical *coerulescens* from Matto Grosso southward, and *superciliaris* (Spix) in eastern Brazil.

963. Sicalis columbiana goeldii Berlepsch

Type locality: Paricatuba, Santarem

Santarem (Chapman and Riker, Hellmayr); Rio Tapajoz, Maracá, Monte Alegre, Eréré, Rio Jamundá (Snethlage); Obidos (Hellmayr)

2 ♂, near Obidos
3 ♂, 7 ♀, Rio Tapajoz, various localities on both banks.
2 ♂, Obidos (Carnegie Mus.)
9 ♂ 4 ♀, Santarem (do.)

This subspecies is quite isolated from true *columbiana*, and has a very scattered distribution of its own. It is characteristic of grassy areas along river banks.

964. Sicalis luteiventris chapmani Ridgway

Type locality: Diamantina, Santarem

Santarem (Chapman and Riker); Rio Tapajoz, Boim and Pinhel (Snethlage)

2 ♂, Lago Grande, west of Rio Tapajoz
8 ♂ 8 ♀, Santarem (Carnegie Mus.)

As now restricted, *chapmani* is exceedingly local.

965. Sicalis luteiventris flavissima Todd

Type locality: Rocana, Pará, Brazil
Mexiana Island (Wallace, Hagmann, Snethlage); Marajo Island (Hellmayr, Snethlage); Monte Alegre (Snethlage, as *arvensis chapmani.*)

Type series in Carnegie Museum examined.

[Sicalis flaveola Linnæus

"Pará" by R. Graham in Brit. Mus. (Sharpe)

If the specific identification is correct, the locality is probably erroneous.]

966. Brachyspiza capensis subsp.

Rio Acará, Monte Alegre (Snethlage)

These birds might be typical *capensis*, or an unnamed form.

967. Myospiza humeralis humeralis (Bosc)

Type locality: Cayenne
Mexiana Island (Wallace, Snethlage); Marajo Island (Hellmayr, Snethlage); Caviana Island (Brodkorb); Monte Alegre, Rio Jamundá (Snethlage)
3 ♂, Rio Tapajoz, Santarem
4 ♂ 1 ♀, Santarem (Carnegie Mus.)

968. Myospiza aurifrons aurifrons (Spix)

Type locality: Fonteboa, Rio Solimoës
Common throughout the area (all collectors), but unrecorded from Marajo and Mexiana Islands
3 ♂ 2 ♀, Rio Tapajoz, Santarem
5 ♂ 5 ♀, Benevides (Carnegie Mus.)
2 ♂, Obidos (do.)
1 ♂, 1 ♀, Santarem (do.)
8 ♂ 3 ♀, Rio Tapajoz, various localities (do.)

969. Emberizoides herbicola subsp.

Mexiana Island (Wallace, Hellmayr)

The only adult is stated to be intermediate between *herbicola* and *sphenurus* (Hellmayr).

970. Coryphospingus cucullatus cucullatus (P.L.S. Müller)

Type locality: Cayenne
Pará region, common (all collectors)
8 ♂ 1 ♀, Benevides (Carnegie Mus.)

971. Paroaria gularis gularis (Linnæus)

Type locality: Guiana
Common throughout our area, but unreported in the Pará region on the south side of the Amazon
27 ♂ 18 ♀, 5 ?, Rio Tapajoz, various localities.
3 ♂ 1 ♀, 1 ?, (do.), (do.) (Carnegie Mus.)
1 ♂ 1 ♀, Obidos (do.)
6 ♂ 1 ♀, Santarem (do.)

972. Arremon taciturnus taciturnus (Hermann)

Type locality: Cayenne
Common throughout our area on the south bank of the Amazon (all collectors); Obidos (Snethlage); unreported from Mexiana and Marajo Islands
2 ♂, Pará, Val-de-Caes
1 ♂ 3 ♀, Rio Acará, Acará, and Buenos Aires
19 ♂ 7 ♀, Rio Tapajoz, various localities
1 ♂, Obidos (Carnegie Mus.)
3 ♂, Benevides (do.)
2 ♀, Santarem (do.)
1 ♂, Rio Tapajoz, Aveiros (do.)
2 ♂, (do.), Villa Braga

The two males from Villa Braga differ in having a narrower pectoral collar which does not meet across the chest.

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No attempt has been made to cite every paper mentioning or discussing Amazonian birds in every sort of connection. To do so would entail a bibliography of gigantic length. Such were formerly thought to add to the learning of the authors, but in these hard times are a waste of severely restricted publication funds.

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A most valuable discussion and summary of the isolated savannahs in Lower Amazonia, which contain birds peculiar to the "campo" fauna.

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This is the well known Aves Amazonicas, the foundation work for our area. It summarizes all preceding papers, which are consequently not listed again in this bibliography.

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A most important paper on the distribution of birds in Lower Amazonia.

1914. Ornith. Monatsber. **22**, pp. 39–44.
Descriptions of new birds from Lower Amazonia.

1924. Journ. f. Ornith., **72**, pp. 446–450.
Descriptions of new birds from Lower Amazonia.

1925a. Bol. Mus. Nac. Rio de Janeiro, **1**, no. 6, pp. 407–412.
A reprint in Portuguese of the preceding article.

1925b. Journ. f. Ornith., **73**, pp. 264–274.
Descriptions of new birds from Lower Amazonia.

1926. Bol. do Mus. Nac. Rio de Janeiro, **2**, no. 6, Nov. 15, pp. 35–70.
A report on study in Europe in 1924–25, of collections made in Brazil at various times 1914–23. The introduction contains general remarks of interest on ecological and avian boundaries in Ceara, Maranhão, and Pará. Lists of the collections follow. List B deals with 143 species from Pará, collected 1914–17, including some records of interest from our area. Unfortunately specific localities are usually omitted.

1930a. ibid, **6**, no. 1, p. 10.
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1930b. Journ. f. Ornith., **78**, pp. 58–65.
Further discussion of the distribution of birds in Brazil.

1936. Bol Mus. Nac. Rio de Janeiro, **12**, no. 2., pp. 83–92.
List of Brazilian Woodpeckers in the museum. Includes some records from Lower Amazonia.

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TODD, W. E. CLYDE

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Review of *Crypturellus variegatus* and its allies.

1937b. ibid, pp. 183–184.
Description of *Chaetura spinicauda acthalea* (Pará).

1937c. ibid, pp. 185–190.
The Pigeons of the *Columba plumbea* group.

1937d. Annals Carnegie Mus., **25**, art. XIX, Nov. 16, pp. 243–255.
Descriptions of numerous new birds from our area.

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1925. Proc, Biol. Soc. Wash., **38**, p. 87.
Pipra iris Schinz the correct name for *P. opalizans* Pelzeln.

1929. Field Mus. Nat. Hist., Zool. Ser., **17**, pp. 3–18.
A review of Deconychura.

1931–1938. Amer Mus. Novitates, nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, 728, 753, 756, 757, 785, 819, 860, 861, 862, 889, 893, 894, 917, 930, 962, 963, 994.
These papers constitute Studies of Peruvian Birds, Nos. I-XXIX. They are really critical reviews of the genera of the families Formicariidae, Furnariidae, Dendrocolaptidae, Pteroptochidae, Conopophagidae, Pipridae and Cotingidae, which occur in Peru.
Whenever pertinent the great Olalla collections of these birds from Lower Amazonia are listed. Numerous taxonomic notes and descriptions of new forms from our area. The last four numbers begin the Tyrannidae. The first twenty-five numbers constitute a "volume", and a title page, contents, and index were issued July 20, 1937.

1938. Proc. Biol. Soc. Wash., **51**, March 18, pp. 47–52.
Critical notes on the members of the *Crypturellus noctivagus* group, occurring in our area.

Bulletin of the Museum of Comparative Zoölogy
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THE RECENT MOLLUSKS OF THE FAMILY NERITIDAE OF THE WESTERN ATLANTIC

By Henry D. Russell

With Seven Plates

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No. 4.—*The Recent Mollusks of the Family Neritidae of the Western Atlantic*[1]

By Henry D. Russell

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INTRODUCTION

This report considers the several species in the family *Neritidae* that are known to occur in the Western Atlantic, a region which extends from Bermuda and North Carolina throughout the West Indian islands to southern Brazil. The majority of the species of the Neritidae found in this area live in salt or brackish water; a few, however, in-

[1] Published with the aid of a special gift from Mr. George R. Agassiz.

habit the freshwater rivers of Central America and certain of the West Indian islands, especially those islands composing the Greater Antilles.

From a taxonomic standpoint only two of the species and subspecies are distinct enough in their characters to have remained more or less clearly understood from the time of their discovery to the present. These are *Nerita peloronta* and *N. versicolor*. The remaining forms have been very imperfectly known, and considerable confusion has resulted as to just what names should be applied to the various species and what limits assigned to the several varieties and subspecies.

Perhaps one of the most important factors in connection with this family is that, as individuals, they are abundant and form a very conspicuous part of the fauna throughout the region that they occupy. There are but few habitat stations in brackish water or on rocky coasts within the American tropics where some member or members of this family do not exist, usually in great profusion. As a consequence, presence or absence of the commoner species of this family, from any area, gives us an index of the amount of collecting that has been accomplished. Certainly this is true as regards the collections in the four largest museums in the United States. Distributional maps for this family will present a fairly accurate picture of the amount of collecting that has been done on the islands and mainland for all the marine mollusks of the West Indian region.

The purpose of this report is to distinguish the several species and subspecies from one another, and also to give as much of the natural history of these animals as has been possible to gather from the literature and personal field experience.

The economic importance of the Neritidae is slight. However, Martin and Uhler, p. 97 have found that *Neritina reclivata* Say is of great significance for game ducks. Probably other species are used as food by wading birds such as flamingos.

Acknowledgments

The author is exceedingly grateful for helpful suggestions and criticism to many individuals. Chief among these is Mr. William J. Clench, Curator of Mollusks at the Museum of Comparative Zoölogy at Harvard, for the privileges granted in the use of the molluscan collections of that institution and for his kindly criticism of the material and its arrangement for the present paper. Also I am grateful to Dr. Arthur W. Weysse of the Department of Biology, Boston Uni-

versity, for many helpful suggestions. I am also indebted to Doctor Paul Bartsch of the National Museum, Washington, for the use of the Neritid collection stored there, and to his assistant, Doctor Harold Rehder. Gratitude is also due Doctor Henry A. Pilsbry of the Academy of Natural Sciences, Philadelphia, for the use and privileges of the Neritid collection of that institution, and to his assistant, Mr. Richard A. McLean. Thanks are expressed to Mr. Calvin Goodrich of the Museum of Zoölogy, Ann Arbor, Michigan, for sending the West Indian Neritid collection of that Museum to the author for examination. I am very grateful to Doctor Ethan A. Andrews of Johns Hopkins University, Maryland, who has greatly aided the present work by his valuable shipments of material from Jamaica.

During the years 1934–1938 five expeditions were made to the West Indian Region under the auspices of the Museum of Comparative Zoölogy at Harvard for the purpose of carrying on biological surveys and making collections of the fauna of certain islands in this area. The author took part in four of these trips and the present paper is based largely upon material collected at these times. In 1934 investigations were carried on at Soledad and Gavilan, Cienfuegos, and Viniales Cuba, under the direction of Mr. W. J. Clench. I was associated with Mr. Clench, in 1935, on an expedition to Cat Island (Clench 1938, A), Bahamas. In the spring of 1936 Mr. Clench visited the northern Bahama Islands, collecting on Grand Bahama, the Abacos, and Eleuthera. During the summer of the same year, the author headed an expedition to Long Island in this archipelago. The island of Mariguana was visited by Emanuel Williams, our local field collector, in December of the same year. I was again associated with Mr. Clench on an expedition to Hispaniola during the summer of 1937. Monte Cristi, Puerto Plata, and Santa Barbara de Samana were intensively studied at this time.

A detailed list of expeditions and collectors in the Bahamas has been published (Clench, 1938, B).

Other collections of Neritidae were made by the author in Bermuda (1930) and southern Florida (1934 and 1936).

The Family NERITIDAE

In form, members of this family range from the rather thin, smooth-shelled, crepiduloid type of *Navicella* to the globose, thick-shelled, rough types of *Nerita;* also from the smooth, subpatelliform types of *Neritilia* and *Smaragdia* to some of the globose, spiny forms of *Theo-*

doxus. In size they range from a few millimeters to over 5 centimeters in length and width. Some members possess a thick or thin periostracum; others have none. Some possess parietal teeth; others have these much reduced or lacking. In all known forms the operculum is calcareous. The sculpture varies throughout the group from smooth to very rough, coarse ridges. The members of this family are all dextral with a lunate aperture and a more or less prominent spire according to the species examined. The food is believed to be of a vegetable nature according to Tryon, (p. 3), probably consisting of algae and even detritus adhering to the substratum.

Geographical Distribution

The *Neritidae* as a family is nearly world-wide in its distribution. It exists, however, mainly in a tropical to temperate belt girdling the earth. For example, we find members of this group from about northern Florida south into Argentina in the western Atlantic and from Great Britain, Northern Europe, and the Mediterranean Sea to Cape Town, South Africa, in the eastern Atlantic. The belt extends from Cape Town to the Red Sea, to India and throughout the Indian Ocean. In the western Pacific we find species existing from Southern Australia and New Zealand through the Polynesian Islands north to China and Japan. In the eastern Pacific, the belt extends from approximately Lower California south to Peru. It is highly probable that more intensive work on the Atlantic and Pacific coasts of South America would materially extend the range of the family southward in these areas. However, we believe that temperature is probably the limiting factor in the distribution of the majority of species.

Like many marine and brackish families of mollusks, the family Neritidae is far richer in species in the tropical Indo-Pacific than in the West Indies. However, most of the genera and subgenera occur in the West Indies.

The island of Jamaica, B. W. I., possesses a number of the most interesting and intermediate forms among the *Nerites* found in the West Indian Region. It is the only locality in this area, as far as is known, that possesses a species peculiar to it, *Fluvinerita tenebricosa* C. B. Adams.

The Radula

H. B. Baker (p. 128), states: "Although more variable than that of the *Helicinidae*, the radula of the Neritidae is still surprisingly stable. The most variable character appears to be the number of cusps on the

E-lateral, although even these differences appear to indicate a certain amount of racial differentiation or can be correlated with age (compare *Neritina virginea*)."

The author has found this to be true to a large extent among the *Neritas* and *Neritinas* of the West Indian region. They vary from *Fluvinerita tenebricosa* C. B. Adams, with slightly roughened E-laterals and undentated marginals to *Neritina clenchi* Russell from fresh water, with about thirty fine but distinct denticles on the E-lateral and highly denticulate marginals.

In general, the terminology of H. B. Baker's 1923 work is used here for the radula teeth. It is as follows:

"R-central rhachidian central

unpaired central (Fischer 1885; middle plate Troschel, 1866–1882).

central A-plate A-central; 1st paired central, 2nd central (Fischer); 1st "between"-plate (Troschel); "wing"-plate (von Martens, 1879); 1st lateral.

A-B-C plates A-, B-, C-centrals; paired centrals (Fischer); "between"-plates (Troschel), laterals.

D-plate D-lateral; comb-lateral or T-lateral (Helicinidae).

E-plate E-lateral; accessory plate (Helicinidae).

D-, E-, plates Capituliform tooth (Fischer), or complex; lateral (Fischer), or laterals; inner lateral "edge", or "mushroom"-plate (Troschel); "umbrella"-plate (von Martens).

Uncini Marginals; lateral lamellar or lamellae of the outer lateral (Troschel); border teeth (von Martens)."

Apparently, there is some confusion in Baker's system of naming the various teeth of the radula, since in his key of definitions on p. 120 the D-lateral is described as the "comb lateral or T-lateral." This can only be the large lateral tooth with an anterior portion that bears denticles, if there are any, and is usually the largest, or principal tooth of the radula. It is usually quite distinct and unmistakable. The E-lateral is defined on the same page as an "accessory plate." This is the Y-shaped tooth pressed against the base of the D-lateral so closely that it is like a part of that tooth. Later, p. 122, the D-lateral is referred to (pl. 9, fig. 2D), which is a Y-shaped tooth, and the text describes this tooth and refers to the lettering as given in that figure.

P. 123 refers to pl. 9, fig. 2E, which is the large cusp-bearing tooth or T-lateral of his key. The text describes this tooth and refers to the lettering on the plate so there can be no mistake as to what is meant by this description. Obviously, there has been a confusion of designation either in the key or the text. I have chosen to call the Y-shaped tooth "D-lateral" and the large T- or cusp-bearing lateral, the "E-lateral" in accordance with the figures on plate 9 of Baker's work.

The Neritoid radula is a primitive one composed of hundreds of teeth, and these teeth vary extremely among the genera and species. A general description of it will suffice here. The radula of each species will be discussed under that species and the degree to which it differs from the general one. The lingual ribbon is composed of a central (R-central) tooth which varies from subtriangular to square in outline. The A-central which is the next tooth laterally from the center is claviform, bearing a more or less prominent outer posterior shoulder. The B-central is small, suboval, and bears an irregular ridge on its exposed surface. Next to this is the C-central which is somewhat larger, with a larger irregular ridge that articulates with that of the B-central. It is about the same shape as the B-central. These two teeth are followed laterally by the D and E-laterals which, as Baker says, are often in such close contact with one another that they cannot be separated without breaking one or the other in that process. The E-lateral resembles a mushroom which has been sectioned vertically into two sagittal halves and a hollow made on the sectioned surface of the "pileus." The "stipe," or pillar, of the second E-lateral articulates with the first in this groove. The outer edge of the "pileus" may be cusped by a few large denticles, smooth, slightly roughened, or bearing many small cusps. The D-lateral is a Y-shaped tooth with a curved lower end. It fits anteriorly across the stipe of the E-lateral. The marginals vary very much among themselves in the same radula. They may be broad or narrow at the base and bear at the free end a hook with longer or shorter denticles or may be smooth at this end but merely like a claw. The outermost marginals are usually long and wedge-shaped with a ridge at the broad, free end which may or may not bear denticles. The accompanying diagram will aid in following this description.

The diagram illustrates the radula of *Neritina reclivata* taken from Baker 1923, and has been selected for containing the necessary parts for discussion. This is relative to *Nerita* and *Neritina*, and not for *Smaragdia* or *Neritilia*. Wherever the word "typical" is used in the descriptions of the radulae in the species sections, it is in relation to

fig. 1 and not in connection with what may be typical for that species or other species. The diagram is merely used as a "yard stick" or standard as a basis for comparison.

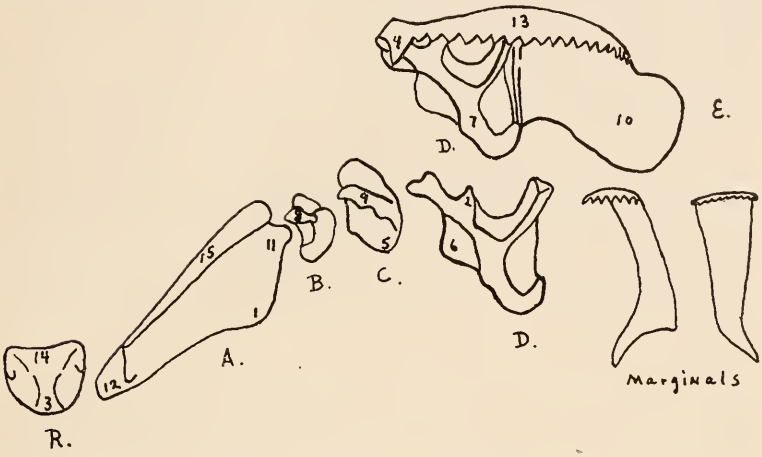

Fig. 1. Typical Neritinoid Radula
R — R central, A — A central, B — B lateral, C — C lateral, D — D lateral, E — E lateral.

1. posterior lobe and point
2. outer projection of inner arm of Y-thickening
3. base
4. major inner cusp
5. base of C-lateral
6. anterior wing directed downward for support
7. base or pillar of E-lateral underlying D-lateral
8. ridge of B-lateral
9. ridge of C-lateral
10. body of E-lateral
11. lateral end of A-lateral
12. central end of A-lateral
13. elliptical reflection
14. thickened upper rim or cusp edge of R-central
15. cusp of A-lateral

Baker, p. 140, speaking of the differences between the shells and opercula of his *Neritina virginea* Linné and *Theodoxus meleagris* Lamarck states, "The above differences will separate practically all

specimens of the two species but the radula appears to be the only infallible character yet described . . . "

"Typical *N. virginea* from Matanzas, Cuba, has 13–15 cusps on the E-lateral; those from Cienfuegos, Cuba, 15–19." Therefore the number of cusps on the same tooth varies by six in the same species. "Typical *N. reclivata* Say from Florida shows 22–27, but a young specimen from Mississippi has only 14."

Age apparently makes a difference in the number of cusps according to Baker, and this factor causes the number of cusps to fall well within the range for *N. virginea* Linné. Where is the line to be drawn between the two specimens, since there is greater variance between the mature specimens of *N. reclivata* and a young specimen than there is between the young of *N. reclivata* and *N. virginea*? The number of cusps on the E-lateral does not seem, therefore, to be an infallible character for determination. Based upon this point alone, it would be impossible to differentiate between the two.

Baker further states, "The R-centrals of the specimens of *N. virginea* and those of *N. reclivata* from Florida show an outline that is longer than broad, while those from Venezuela with as high as 29 cusps on the E-lateral of the older specimens shows an outline that is broader than long. In all specimens the shape of the rim is quite constant when viewed so that it is horizontal. The first lot of zigzag shows 14–15 cusps on the E-marginals, the second 23–25. Nevertheless, the specimens of the same age from a single lot are quite constant. It seems very probable that a careful study of the entire area will show *N. virginea* actually does consist of a number of species, each with its definite range, but, at present, no sharp distinctions seem possible."

Roger, pp. 78–79, finds that the denticles of *Theodoxus* vary in specimens in a small area.

The author finds also that the number of denticles is variable among specimens of the same species. The radula, therefore, is not an "infallible" character for the determination of species and their varieties, but merely an added factor pro or con in the establishment of the relationship among specimens. It must be considered in its proper proportion to the other characters of anatomy, shell, and operculum that constitute the individuals. No *one* of these characters can be set aside as a final and unerring court of appeal whose dictum may be accepted as infallible. The reason for this is that all and each of them is changeable and it is only when the specimen at hand possesses more characters of one kind than another that we can say it is this species or that, this variety or that, or that it is new to science.

Fossil Neritidae

There are over two hundred living species in the Neritidae with an additional sixty or more fossil species. The fossil forms occur from the early Jurassic to the present, with well developed color patterns, and become numerous in the Miocene and Pliocene.

The following paragraphs from "Miocene Mollusks from Bowden, Jamaica, (W. P. Woodring, pp. 423–434) gives a very concise account of the Neritidae in tropical America.

"Nerita has not yet been recorded from the later Tertiary deposits of tropical America, though it is represented in collections of Pliocene Age from Costa Rica. The absence of this genus in the Miocene deposits of this region probably is due to the scarcity among fossils of shells that clung to rocks. Five species of *Neritina* and one of *Smaragdia* have been described from the Oligocene, Miocene, and Pliocene beds of tropical America.

"For some reason fossil Neritinas retain their color markings in a remarkable manner. Among the Miocene mollusks from tropical America they have more distinct color markings than any other genus."

There has, however, been very little change from these earlier forms to the present. Of the two main groups found in the West Indian region, *Nerita* is found from the Jurassic to the present and *Neritina* is found from the Cretaceous to the present.

As far as we know there are no fossil West Indian forms living today.

The Importance of Color Pattern

As in many other groups of animals color *per se* of the individuals of the family *Neritidae* is of little or no value as a specific determinant. It is exceedingly variable, especially with *Neritina virginea* Linné and has probably been one of the chief causes responsible for its extensive synonymy. The pattern of the colors, however, is of far greater importance, since certain species possess a quite constant type of color application to the shells.

General Ecology

The general ecology of the Neritidae inhabiting the West Indian region is extremely varied. In habitat members of this group are found in fresh and brackish to salt and hyper-saline waters, and they can withstand temperatures of from nearly freezing to over ninety degrees

Fahrenheit. No known single species is capable of standing all of these various vicissitudes, of course, but collectively the species do. Certain species are found living on exposed rocks under completely marine conditions. These rocks are beaten constantly by heavy swells, and the Neritidae occurring here are able to withstand the same amount of pounding as the chitons with which they are associated. These *Neritas* usually cling to the rocks from a few feet above high tide mark well into the intertidal zone. One inhabits the undersides of broken boulders in salt water. Others live in the splash pools above high tide mark. These pools range from almost entirely fresh to hypersaline, and the temperature rises to over 90° F. during the day.

Several species prefer the quieter waters of sheltered bays and will even tolerate slightly brackish waters. Some of these brackish water forms are rock lovers, while others dwell in the mud of mangrove swamps. The mangrove swamp *Neritina virginea* L. is often found clinging to the aerial roots of these trees at the lower margin of the intertidal zone. For many hours at a time individuals will remain above the water, subject to desiccation and the heat of the sun. We find certain species that will tolerate both brackish water and completely freshwater conditions, moving back and forth between the two. Finally there are several that inhabit freshwater entirely. These occur on stones or other hard objects usually in riffles or swiftly running water. As far as is known there are no freshwater forms in North America, nor are there any truly terrestrial or semi-arboreal forms in the West Indian region. Outside of the Western Atlantic region *Neritina cornea* Linné is found inhabiting the trees and gardens of the natives in the Solomon Islands, Western Pacific, according to Eyerdam, pp. 44–46. *Theodoxus fluviatilis* Linné can survive in thermal springs and also temperatures near freezing in the rivers of Europe.

Ranges

The ranges of the various species have been divided into the following geographic areas for the sake of clarity and conciseness: United States, Bermuda, East coast of Central America (we are not concerned here with species from the west coast or those found in the west coast drainage systems), East coast of South America (the same as above applies here also), Bahama Ids., Greater Antilles, and Lesser Antilles. The Greater and Lesser Antilles are divided at the Anegada Channel between the Virgin Ids. and Anguilla, St. Martin, St. Bartholomew, Saba, and St. Eustacius Islands. The reason for this is that faunistically the islands west and north of the Anegada Channel seem

to be more closely related among themselves than they do to those islands south and east of them. Likewise, the islands south and east of this Channel seem more closely knit faunistically with themselves than with the islands to the northwest.

Explanation of Maps

The maps showing the distribution of certain of the Neritidae from the West Indian region are based entirely upon specimens examined by the author. No records from the literature have been used. Each lot was examined, determined as to species, and the locality dotted upon a map. Therefore, these maps represent the analysis of a single person. Many of the localities were so close together that a single dot was sufficient for more than one record.

SYSTEMATICS AND TAXONOMY

Measurements

Wherever possible, fifty specimens of each species, ten individuals from each of five different lots, were selected at intervals throughout the range of the species and measured to strike an average for the species. Four measurements were made of each specimen, length, maximum width, minimum width and aperture length.

Abbreviations

Throughout this report the names United States National Museum, Academy of Natural Sciences of Philadelphia and Museum of Comparative Zoology, at Harvard, have been abbreviated to U.S.N.M., A.N.S.P. and M.C.Z. respectively.

The synonymy followed in this report is the same as that of Baker 1923, except as particularly noted among the various species.

Classification of the Western Atlantic Neritidae

Subfamily Neritinae

Genus — *Nerita* s.s. Linné 1758
Nerita peloronta Linné 1758
Nerita versicolor Gmelin 1791
Nerita tessellata Gmelin 1791
Nerita fulgurans Gmelin 1791
Genus — *Fluvinerita* Pilsbry 1932
Fluvinerita tenebricosa C. B. Adams 1851

Genus — Puperita Gray 1857
Puperita pupa Linné 1767
Puperita tristis Orbigny 1842
Genus — Neritina Lamarck 1816
Subgenus — Nereina Cristofori and Jan 1832
Neritina virginea Linné 1758
Neritina clenchi Russell 1940
Neritina meleagris Lamarck 1822
Neritina reclivata Say 1822
Neritina piratica Russell 1940
Neritina zebra Bruguière 1792
Subgenus — Neritina s.s. Lamarck 1816
Neritina punctulata Lamarck 1816
Subfamily Smaragdinae
Genus — Smaragdia Issel 1899
Smaragdia viridis weyssei Russell 1940
Subfamily Neritilinae
Genus — Neritilia von Martens 1879
Neritilia succinea Récluz 1841

Key to the genera of West Indian Neritidae

1. Shell solid, thick; columellar area ridged or papillose, palatal teeth present ..... *Nerita*
   Shell thin; columellar area smooth, palatal teeth absent 2
2. Shell globose 4
   Shell subpatalliform 3
3. Shell greater than 10 x 10 mm 6
   Shell less than 10 x 10 mm 7
4. Operculum lacking peg and periostracal layer along the palatal margin ..... *Fluvinerita*
   Operculum with peg and periostracal layer along the palatal margin 5
5. Operculum opaque white; aperture interior lemon to orange yellow; color pattern dull chalky white with black zigzag lines to black with chalky white spots ..... *Puperita*
   Operculum opaque, black; aperture cream to bluish white; color pattern shiny, composed of lines and spots on yellow, olive, purple, pink or black background ..... *Neritina*
   Subgenus *Nereina*

6. Operculum opaque pinkish white to salmon pink; color pattern rather dull, composed of suboval light yellowish brown spots on a light brown or reddish background .....Subgenus *Neritina* s. s.
7. Operculum opaque, greenish; color pattern shiny peagreen, entire or with scattered suboval white spots often with brownish red posterior edges.....*Smaragdia*
   Operculum slightly transparent horn-colored; color pattern the same, dull.....*Neritilia*

Genus Nerita Linné

Key to the species of Nerita

1. Color pattern, alternating black and white spots.....2
   Color pattern entirely black or with irregularly scattered patches of white.....3
   Color pattern dirty yellow to dirty white with spots or zigzags of black and red.....4
2. Operculum black, convex, papillose.....*Nerita tessellata*
3. Operculum bluish grey to yellow, convex, papillose. *Nerita fulgurans*
4. Operculum consisting of a raised smooth, reddish-horn color part and a lower dark brown slightly papillose part.....5
   Operculum brownish grey, concave papillose.....6
5. Parietal teeth strong one or two in number.....7
6. Parietal teeth strong four to five in number.....8
7. Columellar area concave and bearing a reddish orange spot..... .....*Nerita peloronta*
8. Columellar area convex, white.....*Nerita versicolor*

Nerita peloronta Linné

pl. 1, fig. 1, 2; pl. 5, fig. 1.

Nerita peloronta Linné 1758, Syst. Nat. ed. 10, p. 778.

Type locality. "O. Asiae Ad Bandam" (Linné).

Description. Shell globose and solid. Ground color dirty yellow. Pattern consisting of zigzags of black and red. Shell deeply impregnated by pigment. Whorls 3, rounded in cross section. Spire low, cast at an angle of 120° and often somewhat corroded. Aperture lunate and cast at an angle of 66°. Palatal lip thin, faintly scalloped, sharp, marginate with the callosity bearing 15–23 small teeth. Superior and inferior palatal teeth larger than others; with the interior hinge tooth strong. Parietal area thick, undulated, concave, white to dirty yellow

with irregular red to orange central spot, and bearing one or two strong teeth, one usually larger than the other. Suture faintly impressed. Sculpture consisting of spiral ridges crossed by many faint axial lines of growth which are always present. The spiral ridges may vary greatly in number and from coarse to smooth.

Operculum opaque, calcareous and with interior coral pink. The surface is undulated and shiny with the rib absent. Peg much reduced and pitted. Periostracal layer present along the palatal margin of exterior. Operculum consisting of two sections, the first raised, smooth and orange in color, the second and lower part smooth to papillose and colored a brownish-green.

Radula. R—central oblong in shape.

A—central very much heavier than in fig. 4 and with a rounded prominence between the two ends of the tooth instead of at 1.

B—central with "s" shaped ridge.

C—central typical.

D—lateral about typical but with outer projection of inner arm placed lower on inner arm.

E—lateral with very heavy and large elliptical reflection and bearing no cusps.

Inner marginals with large claw-like anterior portion bearing no cusps. The middle marginals develop about 20 fine cusps and these become approximately 23 coarser and longer denticles. The outermost marginals bear about 20 very fine denticles.

Measurements.

	length	maximum width	minimum width	aperture length
Cuba: Punta de la Sabanilla, Cienfuegos Bay	30.5	34.1	20.7	26.9 mm.
Florida: 24 mi. s.w. of Tavernier Key	29.0	32.3	20.2	26.0
Key West	41.7	45.1	26.1	36.7
Caribbean Sea: Swan Id.	32.0	34.5	20.6	28.0
Bahamas: Arthur's Town, Cat Id.	28.7	30.9	17.5	25.4
Hispaniola: Puerto Sosua	29.3	31.0	19.0	26.0

Remarks. A series from Piscadera Bay, Curaçao, is of interest in that the ground color is lemon yellow in some specimens. The usual red color is lacking and the yellow may be almost entirely obscured by a dark brownish-blue pigment. Also, the marginate teeth on the palatal

callosity are lacking except for the superior two. Some of the specimens possess only one parietal tooth.

Nerita peloronta Linné is strictly a marine species. It is found throughout the West Indies on the rocky coasts, even in places exposed to the full force of the sea. It is seldom found where there is any admixture of fresh water. While collecting this species one is struck with the fact of their ability to hold on to the rocks with a great deal of tenacity, a character which enables this species to maintain its hold on the substratum even during severe storms. This is even more important when one realizes that it is not only the direct pounding of the sea that must be sustained but also a tremendous amount of lateral wave pressure caused by the uneven sea worn rocks that characterize most of the coast line of these West Indian islands.

This species will tolerate but little brackish water. It soon disappears within the mouths of harbors where the sea water has become somewhat freshened from shore drainage.

Range. (see pl. 5, fig. 1).

The range extends from Saint Augustine, Florida, and the Bermudas on the north through Central America and the West Indian islands as far south as Trinidad.

Nerita versicolor Gmelin

pl. 1, fig. 3, 4; pl. 5, fig. 2.

Nerita versicolor Gmelin 1791, Syst. Nat. **I**, pt. 6, p. 3684.

Type locality. "Ad Insulas Antillas" (Gmelin).

Description. Shell solid and globose; color consisting of a variable number of irregular black and red rectangular spots on a dirty white background. The red may be lacking as in specimens from the island of Trinidad. Shell is deeply impregnated by pigment. Whorls 3–3½, rounded in cross section. Spire low and pointed; sometimes considerably corroded, though rarely as much as in *Nerita tessellata* or *Nerita fulgurans*. Spire cast at an angle of 109°. Aperture lunate and cast at an angle of 58½°. Palatal lip thin and sharp, irregularly scallopped and spotted with red, white and black at the margin. It is marginate, marginate callosity bearing 10–15 distinct teeth; superior and inferior teeth stronger than others; interior palatal hinge tooth faint. Parietal area thick, slightly convex and irregularly ridged. It is white to yellowish in color and bears four to five strong teeth—usually four. Suture faintly impressed. No periostracum present. Sculpture consisting of a variable number of rounded, spiral ridges

often dividing once as they approach the aperture. They bear many faint axial lines of growth.

Operculum opaque, calcareous and brownish grey. Rib strong; peg faint to lacking; if present, it is slightly pitted. There is a slight periostracal layer along the palatal margin. Exterior finely papillose and slightly concave.

Radula. R-central more rectangular in outline than is typical.

A-central broad, as wide at central as at lateral end. Posterior lobe prominent and about midway between the two ends.

B-central larger than typical, more elongate.

C-central with narrower base than typical.

D-lateral with larger anterior wing than typical and with outer projection of inner arm of Y-thickening much reduced.

E-lateral with broad elliptical reflection which bears no cusps. There is a large wing at the lateral end of the tooth which is parallel to the base or pillar of it.

Marginals with single claw-like projection. These develop 9–12 long, slender denticles arranged semicircularly as we progress laterally. The outermost marginals bear about 25 denticles.

Measurements.

	length	maximum width	minimum width	aperture length
Cuba: Punta de los Colorados, Cienfuegos Bay	21.6	21.1	15.3	18.3 mm.
Trinidad: Toco	25.6	28.3	17.6	22.7
Bermudas	26.9	28.1	17.2	23.4
Honduras: Oak Ridge, Ruatan Id.	21.7	23.8	14.5	19.4
Florida: Plantation Key	20.	21.1	13.4	17.9

Remarks. There has been a certain amount of confusion with *Nerita versicolor* Gmelin in the past, but today the species is well defined by its shape and arrangement of the columellar teeth which separate it from any other known member of the family *Neritidae* in the West Indies. The color pattern varies somewhat but, as a rule, is very stable.

N. versicolor, like *Nerita peloronta* Linné lives on the most exposed coastal rocks in salt water. The author has gathered specimens of both these species from the most exposed rocks of the outermost islands of the Bahamas where the full force of the Atlantic swells beat unchecked on the rocky headlands. Both these species exist side by side, yet never seem to interbreed. They are not found on sand or in fresh water, but will occasionally exist in *slightly brackish water.*

Range. (see pl. 5, fig. 2).

The range extends from Saint Augustine, Florida, and the Bermudas through the West Indian islands and Central and South America as far as Para, Brazil.

Nerita fulgurans Gmelin

pl. 1, fig. 5, 6; pl. 6, fig. 1.

Nerita fulgurans Gmelin 1791, Syst. Nat. **I**, pt. 6, p. 3685.
Nerita antillarum Gmelin 1791, Syst. Nat. **1**, pt. 6, p. 3685.

Type locality. "Frequens ad Insulas Antillas" (Gmelin).

Description. Shell globose and solid. Color consisting of an irregular marbling of black and white areas; often the white is indented below the black, the white appearing to be worn away leaving the black portion raised above it. Shell deeply impregnated with pigment. Whorls 2½ to 3¾, rounded in cross section. Spire low, often badly corroded and cast at an angle of 132°. Aperture lunate and cast at an angle of 59°. Palatal lip thin, sharp, irregularly scalloped with a thin band, black or irregularly spotted with white at the margin. Marginate with a callosity bearing 12 to 15 distinct teeth, superior two teeth and inferior one tooth stronger than others; interior palatal hinge tooth weak. Parietal area thick, concave and irregularly papillose, white to yellowish, bearing two distinct central teeth. Suture faintly impressed. No periostracum present. Sculpture consists of a variable number of crenulated spiral ridges showing many faint spirewardly curved, axial lines of growth. Irregular black portions stand above the worn white ones as noted above. Spiral ridges tend to divide once or twice as they approach the aperture.

Operculum opaque, calcareous, slightly convex and bluish grey to yellowish in color. Exterior irregularly and finely papillose. Rib usually strong with peg pitted and much reduced; periostracal layer developed along the palatal margin.

Radula. R—central typical in outline and bearing a "V" shaped base (fig. 1, R, 3).

A—central heavier than typical with less prominent posterior lobe, but with a rounded prominence between the ends of the tooth on that side.

B—central with more "s" shaped ridge than typical.

C—central typical.

D—lateral with reduced to lacking outer projection of inner arm of Y-thickening.

E—lateral with large heavy elliptical reflection bearing no cusps.

Inner marginals with smooth claw-like anterior portion. Proceeding laterally, however, these teeth become cusped with 8 or more long ones. The outermost marginals also appear to possess fine dentations.

Measurements.

	length	maximum width	minimum width	aperture length
Florida: Tahiti Beach	20.2	22.8	14.2	19.2 mm.
Key West	25.9	28.6	17.3	24.4
Cuba: Punta La Milpa, Cienfuegos Bay	19.4	21.6	13.5	19.9
Santo Domingo: Sta. Barbara de Samana	17.1	18.9	12.0	16.3
Trinidad: Toco	22.4	24.5	15.0	19.9
Brazil: Puerto Seguro	15.3	17.3	10.8	14.7

Remarks. Nerita fulgurans Gmel. can always be distinguished from *Nerita tessellata* Gmel. by the bluish-grey to yellow cast of the operculum which is decidedly black in the latter form. The color patterns are quite different; that of true *N. tessellata* is a series of distinct black and white alternating dots while that of *N. fulgurans* Gmel. is far more blurred and irregular. The spiral ridges of *N. fulgurans* are usually more numerous. The aperture is wider in relation to its length in *N. fulgurans* and the columellar teeth are more prominent. The most striking difference is the operculum which separates these two species at a glance since that of *N. fulgurans* is bluish-white, while that of *N. tessellata* is black. *N. fulgurans*, as a species, is usually somewhat larger than *N. tessellata*.

Nerita fulgurans Gmelin is only found where there is a moderate amount of brackish water. It generally replaces *N. tessellata* within the mouths of harbors where the water is only slightly freshened but not, however, strictly brackish. Conditions of this sort only exist where there are fairly sizable rivers entering rather large harbor enclosures, where the admixture of salt and fresh water is more or less constant at all times. These would explain the absence of this form in the Bahamas where conditions of this sort do not exist, as well as many other of the smaller islands found in the West Indies.

Where found, this species is exceedingly abundant and its absence from so much of the territory throughout the West Indies is due to its peculiar ecologic requirements.

Range. (see pl. 6, fig. 1)

The range extends from Fort Lauderdale, Florida, and the Bermudas through the West Indian islands and Central and South America to about Porto Seguro, Brazil.

Nerita tessellata Gmelin

pl. 1, fig. 7, 8. pl. 6, fig. 2.

Nerita tessellata Gmelin 1791, Syst. Nat. **I**, Pt. 6, p. 3685.

Type locality. "ad insulas inter Africam et Medium Americanam intersitas" (Gmelin). These are probably the West Indian islands since specimens similar to Gmelin's description are found there and not in the Madeira, Cape Verde or Canary Islands.

Description. Shell solid and globose. Color consisting of alternating irregularly shaped, raised black spots and indented, dirty-white spots. Shell deeply impregnated with pigment. Whorls 2½, rounded in cross section. Spire low cast at an angle of 118° and often considerably corroded. Aperture lunate, cast at an angle of 63°. Palatal lip thin, sharp, irregularly scallopped and marginate. Marginate callosity bearing 13 to 18 distinct teeth. Superior and inferior palatal teeth larger than the others. Interior palatal hinge tooth faint. Parietal area thick, concave, papillose, bluish-white and bearing two weak central teeth. Suture faintly impressed. No periostracum present. Sculpture consisting of a variable number of spiral ridges broken irregularly by alternating high and low areas; often faint axil lines are present and often the ridges break up forming two or three smaller ones as they approach the aperture.

Operculum opaque, calcareous and black. Exterior finely papillose. Rib strong and peg much reduced and pitted. Periostracal layer present along the palatal margin. Exterior slightly convex.

Radula. R-central typical with two small projections at the rounded end.

A-central narrow towards the center, but very heavy laterally with a prominent posterior lobe, tooth shaped like a leg of mutton with the small end towards the center.

B-central about typical with "s" shaped ridge.

C-central typical.

D-lateral with outer projection of inner arm of Y-thickening lacking.

E-lateral with large elliptical reflection which is smooth on the edge towards the center and develops a variable number of small denticles laterally. Inner marginals with single large claw-like

anterior portion. Laterally the teeth become cusped first with about 8 short, broad, blunt ones and later with about 12 longer finer denticles semi-circularly arranged. The outermost laterals bear 12 to about 15 small cusps.

Measurements

	length	maximum width	minimum width	aperture length
Santo Domingo: Sta. Barbara de Samana	14.9	17.0	10.6	14.6 mm.
Cuba: Cayo Frances, Caibarien, St. Clara Prov.	18.5	21.1	13.3	16.2
Florida: Biscayne Bay	14.8	16.7	10.5	13.8
Tahiti Beach	15.0	17.0	10.7	13.7
Bermuda	18.1	20.8	12.7	16.7
Bahamas: Clarence Town, Long Id.	16.3	17.4	10.5	14.7

Remarks. Nerita tessellata Gmelin is more closely allied to *N. fulgurans* Gmelin than to any other species from the West Indian region. There has been a certain amount of confusion with these two species among earlier authors, but as discussed under *N. fulgurans* they may be readily distinguished.

Nerita tessellata Gmelin, similar to *N. peloronta* and *versicolor*, is found only where purely marine conditions exist. It will not, however, be found where wave action is strong unless there is suitable protection in rather deep cracks and crevices. It appears to be most abundant where there is plenty of broken rock which affords the necessary protection. It will, however, stand a little more brackish water than both of the above two species and will extend into the territory occupied by *N. fulgurans*.

This species has a tendency to congregate in rather large numbers, clustering together sometimes as many as 200 under a single small rock. It would appear to have a distinct association complex, as specimens will be found grouped usually in a single mass under a rock with no stragglers in other spots where, apparently, there is just as much protection. Species of other mollusks, which also seem to need protection, will be found scattered as individuals well over the underside of the same rock.

Range. (see pl. 6, fig. 2).

The range extends from Jacksonville, Florida, and the Bermudas through the West Indian islands and Central and South America to Para, Brazil.

Genus Fluvinerita Pilsbry 1932

Genotype *Nerita* (*Fluvinerita*) *alticolor* Pilsbry

Fluvinerita tenebricosa (C. B. Adams)

pl. 2, fig. 1, 2

Neritina tenebricosa C. B. Adams 1851, Contrib. to Conch. **1**, p. 175; von Martens 1879, Conchy.-Cab. 2, pt. 10, p. 260.

Nerita (*Fluvinerita*) *alticolor* Pilsbry 1932, Proc. Acad. Nat. Sci. Phila. **84**, pp. 12–13, fig. 1–2.

Type locality. Black River, Jamaica (C. B. Adams).

Description. Shell globose and thin. Ground color dark brown to horn-color with very angular, dark brown, zigzag lines traversing the whorls with the angles directed from aperture towards the spire. Many of the specimens are of such a dark purplish-brown that these angular lines are not always visible. It is only when they cross a light, horn-colored area that they become apparent. Shell is thinly impregnated by pigment which scrapes off easily leaving a bluish-white surface exposed. Whorls 3–3½. Spire low, cast at an angle of 126°. Spire tends to be occasionally corroded, though not extensively so. Aperture lunate, cast at an angle of 58°. Palatal lip thin, sharp, smooth and bluish. Palatal hinge tooth absent. Parietal area slightly convex, smooth and bearing no teeth. Suture faintly impressed. Periostracum present and thin. Sculpture consists of many faint axial growth lines.

Operculum opaque, calcareous and brownish-white. Periostracal layer absent along the palatal margin. Rib strong and peg lacking. Exterior face of operculum bearing lines of growth radiating from the nucleus.

Radula. R-central approximately square with anterior edge prolonged into a long rounded point.

A-central as in fig. 1 with prominent anterior shoulder.

B & C-centrals typical.

D-lateral typical but with outer projection of inner arm of Y-thickening much reduced.

E-lateral with heavy large elliptical reflection bearing on cusps.

Marginals — those nearest the center with a few blunt denticles. As they proceed away from the center the denticles increase in size and number to about 8. Outermost laterals seem to have no denticles.

Measurements. All localities are in Jamaica.

	length	maximum width	minimum width	aperture length
Catadupa St., near Spanish Dam	7.5	8.0	5.2	7.0 mm.
Gt. River, Hanover Side	9.3	10.0	6.4	8.6
Gt. River	10.9	12.0	7.0	9.8

Remarks. Nerita (*Fluvinerita*) *alticolor* Pilsbry is identical with specimens described by C. B. Adams, l.c. 1851, as *Neritina tenebricosa* from the Black River, Jamaica. Pilsbry's specimens (l.c. 1932) are from the Great River, Jamaica, 18 miles from the mouth and at an elevation of 1000 ft. Specimens named by Adams as examples of his species have been examined (U.S.N.M.). No differences are to be found between Pilsbry's and Adams' species. Adams' name takes priority in being of an earlier date. However, Pilsbry created a new subgenus, *Fluvinerita,* with his species *alticolor* as the type. *Fluvinerita* is here considered as of generic rather than subgeneric rank, because of radula and operculum characters. The holotype for *Fluvinerita alticolor* is A.N.S.P. no. 153559 and one paratype in the M.C.Z. no. 83952.

In shape *Fluvinerita tenebricosa* resembles *Neritina virginea* Linné but is more globose than is typical for that species. The operculum, however, resembles that of *Theodoxus fluviatilis* Linné in shape and in lacking a peg. The color of the two opercula is quite different; that of *Fluvinerita tenebricosa* being brownish blue, while that of *Theodoxus fluviatilis* is chalky white. Except for the above points of similarity, these two species are very different. *Fluvinerita tenebricosa* is a globose form with a low but distinct spire, a relatively shorter palatal lip and narrower columella area than *Theodoxus fluviatilis,* which is subpatelliform in shape with an extremely low spire. The color patterns also vary markedly; that of *F. tenebricosa* is a dark brown to horn color while that of *T. fluviatilis* may be red, purple or brown and with white spots. The radula of both is distinctly Neritoid, but that of *F. tenebricosa* possesses a more rectangular A-central and very fine irregular denticles on the E-lateral, while *T. fluviatilis* has a more triangular shaped A-central with a very prominent posterior lobe, and the E-lateral bears 17–18 distinct denticles. Furthermore, *F. tenebricosa* is limited to freshwater rivers of Jamaica while *T. fluviatilis* occurs in the freshwater rivers, thermal springs and even in sea water in Europe.

Fluvinerita tenebricosa C. B. Adams is distinctly a freshwater species, in the deep, strong current of the Great River, Jamaica. Dr. Pilsbry, as above, records *Nerita* (*Fluvinerita*) *alticolor* = *Fluvinerita*

tenebricosa Adams, from eighteen miles above the mouth of the Great River, Jamaica, and at an elevation of 1000 feet above sea level. It was originally reported from the Black River, Jamaica, by C. B. Adams 1851.

Range. Known only from the rivers of Jamaica.

Genus Puperita Gray

Key to the species of Puperita

1. Color pattern chalky white with zigzag black lines 2
   Color pattern black with white spots 3
2. Aperture light to dark orange yellow 4
3. Aperture bluish yellow to bluish white 5
4. In general the larger of the two species ..... *Puperita pupa*
5. In general the smaller of the two species ..... *Puperita tristis*

Puperita pupa (Linné)

pl. 2, fig. 3, 4

Nerita pupa Linné 1767, Syst. Nat., ed. 12, 1253–1254.

Type locality. Mauritius (Linné).

Mauritius, the type locality, as given by Linné, is unquestionably an error. It has not been reported from there since so far as I know.

Description. Shell thin and globose. Ground color chalky white crossed by a few or many zigzag, bifurcating black lines. These lines vary greatly in number and width; often they outline the white areas making irregular spots of them. The spots vary in size, number and shape. Shell thinly impregnated by pigment which scrapes off easily leaving a chalky surface exposed. Whorls 2⅓, rounded in cross section. Spire very low, cast at an angle of 113°; often considerably corroded. Aperture lunate cast at an angle of 57°. Palatal hinge tooth faint to lacking. Palatal lip thin and sharp, smooth and greyish yellow to deep yellow. Parietal area thick, smooth, flat to slightly concave, and bearing 3–5 small irregular teeth. Suture faintly impressed. Periostracum present. Sculpture consisting of very faint axial growth lines. Usually a hand lens is necessary to see them.

Operculum opaque, calcareous and yellowish. Peg smooth and has a tendency to be reduced. Rib strong. Periostracal layer present along the palatal margin. Exterior bearing radiating lines of growth from the nucleus.

Radula. R-central, shaped as a rather long heraldic shield.

A-central with heavy posterior lobe nearer the R-central tooth than in the typical form.

B-central typical.

C-central typical.

D-lateral typical with much reduced outer projection of inner arm of Y-thickening.

E-lateral with heavy, large elliptical reflection and often bearing a variable number of many fine cusps. Inner marginals with single large claw-like anterior portion. As we proceed outwards, 8 or 10 long denticles are developed. The outermost marginals appear to bear about fifteen very small cusps.

Measurements.	length	maximum width	minimum width	aperture length
Bahamas: Gt. Inagua Id.				
Matthew Town	9.6	10.4	6.6	8.8 mm.
Gd. Bahama Id.				
Eight Mile Rock	10.1	10.6	6.8	9.1
Santo Domingo:				
Puerto Sosua	9.5	10.0	6.2	8.5
Cuba: Havana	8.9	9.7	5.8	8.2
Florida: Key Vacca,				
East Sister Key	10.5	9.8	7.4	9.5

Remarks. According to Thiele, p. 73, there are a few species of his subgenus, *Puperita*, that occur in the Pacific Ocean. Whether or not these are definitely members of this genus, I cannot say. They do not concern us here. However, since Gray 1857 has established *Nerita pupa* L. 1767 as the type of his subgenus, *Puperita*, this subgenus must either be placed under the genus *Neritina*, as has been done by previous authors, or it must be given generic rank. Because, as given above, it does not entirely exhibit the characters of either the genus *Nerita* or those of *Neritina*, I prefer to consider it a separate genus standing between the two and closer in relationship to the genus *Neritina*.

Puperita pupa Linné is one of the most curious species of the family Neritidae from the point of view of its habitat. It dwells in pools in the coastal rock within the spray zone and splash from the waves. At times during heavy rains these pools are almost entirely fresh and at other times, as during storms, they are entirely hypersaline or at least as salt as the ocean water. This species has been found inhabiting splash pools in Santo Domingo that were over 90° F. and exposed to the full brilliance of the tropical sun. A few moments later a travelling rain cloud, or "chawasco", would pass. For perhaps twenty minutes the heavy rains deluged the coast. Then the weather would clear.

This might happen several times in an afternoon. To what degree the storms would lower the temperature of the splash pools, I do not know, but it must be considerable since tropical rain feels very cold to those drenched by it. Not only the salinity, but also the temperature of the environment of *P. pupa* must, therefore, be radically changed in a short period of time. With a calm sea, such as during the calms of August when there is little splash from the waves and the sun beats down on these splash pools, evaporating the water from them, the salt content must consequently rise considerably and these pools must become hypersaline. This is another environmental change, though not as rapid as those above. *P. pupa* must be able to withstand it. Unlike *Nerita peloronta* and *N. versicolor*, *P. pupa* is not found above the water, but always immersed in it. Presumably, it feeds upon algae in the splash pools. Where this species is found, it usually occurs in considerable numbers.

Range.

United States: Florida — Big Pine Key.

Bahama Islands: Grand Bahama Island — Settlement Point; Eight Mile Rock.

New Providence — Nassau

Andros — Mangrove Cay

Little San Salvador — 18 mi. N.W. of Cat Island

Cat Island — Arthur's Town

Long Island — Cape Santa Maria; Clarence Town

Mayaguana — Northeast Point

Great Inagua — Mathew Town

Greater Antilles: Cuba — Cape San Antonio; Havana; Cabarien; Cochinos Bay; Cienfuegos Bay. Santiago

Grand Cayman — George Town

Little Cayman Island

Gonaive Island

Santo Domingo — Puerto Plata; Santa Barbara de Samana

Jamaica — Negril Point; Annotta Bay

Virgin Islands — St. Thomas; St. Croix

Lesser Antilles: Barbados — Bridgetown

South America: Colombia — Cartegena

Puperita tristis (D'Orbigny)

pl. 2, fig. 5, 6

Neritina tristis D'Orbigny 1842, in Ramon de la Sagra Histoire Physique, Politique et Naturelle de L'Ile de Cuba, **2**, pp. 47–48, pl. 27, fig. 35.

Type locality. Cuba (D'Orbigny).

Description. Shell, globose and thin. Ground color black with many irregular, chalky white spots varying in size, number and shape. Shell thinly impregnated with pigment which scrapes off easily leaving a yellow to white surface exposed. Whorls 2 1/3, rounded in cross section. Spire very low, cast at an angle of 124°, usually partially to much corroded. Aperture lunate, cast at an angle of 73°. Palatal lip thin, sharp, smooth, greyish or bluish yellow, never the deep yellow of *Nerita pupa* L. Palatal hinge-tooth weak. Parietal area flat to slightly concave, smooth and bearing 3–5 small irregular teeth along the columellar margin. Suture faintly impressed. Periostracum present but thin. Sculpture consists of very faint axial growth lines; a hand lens is usually necessary to see them.

Operculum calcareous, opaque, bluish white to yellowish. Peg smooth and strong; rib strong. Periostracal layer present along the palatal margin. Exterior face of operculum bearing lines of growth radiating from the nucleus.

Radula. R-central more rectangular than typical.

A-central heavier at central end than typical and with a much greater rounded posterior lobe nearer the center of the tooth than typical.

B-central with "s" shaped ridge.

C-central typical.

D-lateral with outer projection of inner arm of Y-thickening lacking.

E-lateral with elliptical reflection broad and smooth on the edge, slightly roughened as if by wear or bearing twenty or more small denticles; major inner cusp often much larger than typical. Inner laterals with single, large claw-like anterior portion. This claw developes about 10 heavy, short denticles and these become curved, long, and slender and arranged somewhat semicircularly as we pass laterally. Outermost laterals appear to be minutely denticulate.

Measurements.

	length	maximum width	minimum width	aperture length
Guadeloupe Id.	7.7	8.0	5.0	7.1 mm.
Virgin Id.: Guana Id., Tortola	7.6	8.1	5.1	6.9
Honduras	9.8	9.3	5.9	8.0
Cuba: Guantanamo	8.4	8.8	5.5	7.6
Havana	8.8	9.4	5.8	8.7

Remarks. Puperita tristis D'Orbigny has previously been considered a subspecies or variety of *Puperita pupa* Linné. Tryon, (p. 42) considers *Puperita tristis* D'Orbigny a synonym of *Neritina pupa* and von Martens (Conchy.-Cab. 2, pt. 10, 1877, p. 130) considers *Neritina tristis* D'Orbigny a variety of *Neritina pupa* Linné.

In view of similarities of shell shape and type of color pattern, as well as the presence of a periostracum, I believe that *Puperita* should be considered a genus, standing between *Nerita* and *Neritina*. The radula possesses characters of both genera. *Puperita tristis* D'Orbigny, in most cases, possesses a color pattern distinct from *Puperita pupa* Linné though there are occasional intergrades between the two forms. *P. tristis* is usually smaller and has a pale yellow interior of the aperture rather than the yellow orange of *P. pupa*. The ranges of the two species overlap but are not coextensive and the radulae differ somewhat in that the E-lateral of *tristis* tends to be far more distinctly cusped than that of *pupa*. For the above reason *tristis* is here considered a full species.

Puperita tristis D'Orbigny has the same ecologic habits as *P. pupa*.

Range. Greater Antilles: Cuba — Corrientes Bay; Havana; Cienfuegos Bay; Santiago
Rosario Key 45 mi. W. of Isle of Pines
Haiti — Miragoane; Saltrou; Isle à la Tortue (Tortuga)
Jamaica — Montego Bay; Annotta Bay; South East Point
Virgin Islands — St. Thomas; Tortola
Lesser Antilles: Marie Galante
Barbados — Bridgetown

Genus Neritina Lamarck

Key to the species of Neritina

1. Shell globose 2
   Shell subpatelliform 3
2. Operculum black to bluish black 4
3. Operculum pinkish white to salmon pink ..... *Neritina punctulata*
4. Ground color of shell often containing red, lavender or purple ... 5
   Ground color of shell olivaceous green or yellow 6
5. Color pattern consisting of dark zigzag lines and lighter spots with the leading edge outlined in heavy black .... *Neritina virginea*
   Color pattern consisting of dark zigzag lines and lighter spots with the leading edge outlined with white, white and black or white and red; suggests imbricating scales ..... *Neritina meleagris*

6. Color pattern consisting of zigzag dark more or less parallel lines and lighter spots 10
   Color pattern consisting of black more or less parallel lines, very closely set 7
   Color pattern consisting of black more or less parallel lines, not very closely set 8
   Color pattern consisting of black lines forming a reticulated triangular or diamond shaped network . . . . . *Neritina piratica*
7. Palatal lip sharp not marginate 9
8. Palatal lip usually marginate . . . . . *Neritina zebra*
9. Edge of parietal area opposite parietal teeth, bluish white or with faint yellowish tinge . . . . . *Neritina reclivata*
10. Edge of parietal area opposite parietal teeth outlined with dark orange yellow . . . . . *Neritina clenchi*

Subgenus Nereina Cristofori & Jan 1832

Neritina virginea (Linné)

pl. 2, fig. 7, 8; pl. 7, fig. 1

Nerita virginea Linné 1758, Syst. Nat. ed. 10, T.I. p. 778.

Type locality. Mediterranean Sea (Linné).

Description. Shell globose and thin. Color very variable consisting of crooked axial lines varying in color from black to pink to purple and red, and irregular olivaceous to white spots, varying in size, shape, and number. The ground color of the shell is olivaceous, yellowish or white, and the color is given to the pattern mainly by the crooked axial lines which make the color deeper the closer together they occur, and fainter as they move apart. On many specimens the color occurs solidly or in spiral bands, sometimes solid, sometimes broken by spots. The pattern varies from solid black with a few small, white spots to white with a few irregular black lines. The "leading" or aperture edge of the spots is almost invariably outlined with a heavy, solid black margin. The "trailing" or spireward edge is not. The shell is thinly impregnated by pigment which scrapes off easily, leaving a yellowish white surface exposed. Whorls, 3, rounded in cross-section. Spire, low and cast at an angle of 105°. Aperture, lunate and cast at an angle of 74°. Palatal lip long, thin, and sharp, smooth, and bearing no teeth, yellowish to bluish white. Palatal hinge tooth weak. Parietal area smooth, convex, white to yellowish, bearing a variable number of

small, irregular teeth. Suture faintly impressed. Periostracum thin. Sculpture consisting of many faint axial lines.

Operculum opaque, calcareous and usually black. Exterior bearing faint lines of growth radiating from the nucleus. Rib smooth, rib and peg strong. Periostracal layer present along the palatal margin.

Radula. R-central square to rectangular; cusp edge sometimes develops two lateral processes that resemble blunt to rather long, curved horns.

A-central typical but with a more curved cusp edge than typical.

B-central typical.

C-central typical to slightly wider than typical.

D-lateral typical.

E-lateral with wide elliptical reflection bearing 8–9 large pointed denticles, very much larger than typical. Major inner cusp much more prominent than typical.

Inner marginals bearing 7–9 pointed denticles on the anterior edge. Middle marginals with 9–11 longer, more curved denticles arranged somewhat semicircularly. Outermost laterals appear uncusped.

Measurements.

	length	maximum width	minimum width	aperture length
Santo Domingo: Rio Manjon, Puerto Plata	18.9	19.1	12.1	16.0 mm.
Florida: New River, Fort Lauderdale	16.1	15.6	9.9	12.6
Brasil: Bahia	9.3	9.1	6.1	8.2
Guatemala: Puerto Barrios	10.0	10.6	6.9	9.0
Bahamas: New Providence Id. Old Fort, Nassau	11.8	12.1	7.9	10.1

Remarks. Nerita listeri Pfeiffer. Pfeiffer, p. 255 describes a shell that might be one of several species from the West Indian region and refers for a figure to Lister, Hist. Sive Synop. Method. Conchyl. et tabularum anatomicarum pl. 604, fig. 26, 27, 1688. Lister's figures 26 and 27, pl. 604 of this work are without question *Neritina virginea* Linné. *Neritina listeri* of the literature has previously been ascribed to Pfeiffer, but, as above, it is here considered to be a synonym of *N. virginea* L. since Lister's description is somewhat doubtful as to the species meant and the figure to which he refers is definitely that of *N. virginea* L.

Neritina virginea (Linné) is one of the most abundant and variable forms occurring in the West Indian region. It extends almost through-

out the region and thus has the most extensive range of any of the species found within these limits. Its synonymy is enormous as Tryon, p. 40 says. This is due in part to the great variety and number of color patterns exhibited by this species. Also, the extensiveness and the abundance of specimens throughout the range has brought it to the attention of many travellers and investigators in these regions. Thus, specimens of this species have found their way into many museum collections of natural history and many names have been given to the various color-pattern forms.

N. virginea (Linné) finds its counterparts in regard to variability of color pattern in *Neritina ualanensis* Lesson from the Indian Ocean and Polynesia and in *Theodoxus fluviatilis* Linné from Europe. *Neritina ualanensis* Lesson is a lower spired, more globose form, usually with a more angulated type of color pattern and tends in the majority of cases to be smaller than *N. virginea* Linné, and it also possesses an operculum with a peg and rib of about equal length and firmly united by a central section or buttress. These characters readily separate the two species. They are both inhabitants of brackish water.

Theodoxus fluviatilis passes through many variable color pattern-forms somewhat similar to *N. virginea*, but may easily be distinguished from the latter by its subpatelliform shape with low spire, flat parietal area and usually smaller size and white operculum which lacks a peg. It is an inhabitant of fresh water, thermal and salt springs, brackish and even sea water.

An examination of the specimens of *N. virginea* (Linné), *N. clenchi* Russell, and *N. reclivata* Say brings out the following points of interest: *N. virginea* is a brackish water species with richly or brightly colored color pattern. The radulae among these species vary in the dimensions of the teeth and proportionate measurements. This takes place from individual to individual in the same lot but principally the denticles of the E-lateral vary and fall into certain rather elastic groups. For example, we find that the E-lateral denticles of *N. virginea* from brackish water number from about five large coarse ones to ten finer ones. The next group is composed of intermediate specimens which, in regard to color pattern, fall between *N. reclivata* and *N. virginea*. The denticles of the E-lateral number approximately 10–14. Following this, are specimens of *N. reclivata* with E-lateral denticles numbering from 8 or 9 to from 17 to 22. The latter figures were in the majority of those counted. The next group is *N. clenchi* which bears about 21–29 E-lateral denticles. From the point of view of ecology, we find that the specimens with the least number of E-lateral denticles,

that is, *N. virginea* occur in brackish water and that as the water becomes more fresh the number of E-lateral denticles increases until where the water is entirely fresh we find the greatest number in *N. clenchi*. Correlated with this denticular change, are changes in shell size, color pattern, and the operculum. Nothing can be speculated concerning these facts at this time since adequate data concerning the subject are lacking. It may be that at some future date further information from other regions may make an explanation possible.

Neritina virginea (Linné) is a species of the mangrove swamps and is strictly a brackish water form. It does, however, prefer the lower margin of such swamps where there is only a short exposure to the air at low tide. It appears to be most abundant around the mouths of creeks and rivers though it will not advance beyond the area of brackish water.

Range. (see pl. 7, fig. 1). The range extends from Saint Augustine, Florida, and the Bermudas through the West Indian islands and Central and South America as far south as Itabapinana, Brasil.

Neritina clenchi Russell

pl. 3, fig. 1

Neritina clenchi Russell 1940, Memorias de la Sociedad Cubana de Hist. Nat., **14**, no. 4, pp. 261–262, pl. 46, figs. 1, 2.

Type locality. Rio Manjon, 7 km. s. e. of Puerto Plata, Santo Domingo.

Description. Shell globose and thin. Color black to olivaceous consisting of crooked axial black lines and white to olivaceous irregular spots that vary in shape, size and number. The "leading", or aperture, edge is outlined in heavy black; the "trailing", spireward, edge is not. The shell is thinly impregnated by the pigment which scrapes off easily leaving a yellow-white area exposed. Whorls, 2½, rounded in cross section. Spire low, usually much corroded, and cast at an angle of 115°. Aperture lunate, and cast at an angle of 75°. Palatal lip long and thin, sharp and smooth and bearing no teeth, edge yellowish to bluish-white interior. Palatal hinge tooth weak. Parietal area smooth, convex and white with a yellow to orange edge except where the small irregular teeth are borne on the columellar edge. Suture faintly impressed. Periostracum thin. Sculpture consisting of many faint axial lines.

Operculum opaque, calcareous and black to pink. Exterior bearing

faint lines of growth radiating from the nucleus. Peg strong, rib has a tendency to be reduced. Peg smooth. Periostracal layer present along the palatal margin.

Radula. R-central slightly longer than wide.

A-central heavy; rather short in proportion to its width with broadly rounded posterior lobe.

B-central typical.

C-central typical.

D-lateral typical but with reduced outer projection of inner arm of Y-thickening.

E-lateral typical and bearing 22–29 small, distinct denticles on the anterior edge of the elliptical reflection.

Inner marginals with long claw-like anterior portion bearing 9–10 rather short denticles. The middle marginals bear about the same number of longer, more curved cusps arranged in an oval formation. The outermost marginals appear typical and uncusped.

Measurements.

	length	maximum width	minimum width	aperture length
Santo Domingo: Rio Manjon, Puerto Plata	18.0	18.0	11.4	14.3 mm.
Cuba: Rio Arimao, Cienfuegos	18.9	19.0	12.0	16.1
Jamaica: Great River	19.4	19.7	12.7	15.9
Montego River	16.8	17.0	10.6	14.4
Cuba: Rio San Juan, Mantanzas Prov.	19.9	19.1	13.7	16.4
Guatemala: Cavech River, Livingston	20.1	19.1	12.7	16.7

The specimens from the Great River, Jamaica, were very abnormal in shape in that they were badly corroded at the spire and the animal had tried to cover growths of calcareous algae on the whorls with shell. The algae grew mainly on the body or last whorl at the base of the parietal area.

The holotype for this species is M.C.Z. no. 115,701.

Remarks. Certain specimens are from Salt Pond, Montego Bay, Jamaica, where there is a town dump and which is sometimes open to the ocean and sometimes not. These specimens resemble *Neritina smithi* Gray from Calcutta, India, in shape and color pattern, but are smaller.

Neritina clenchi is a freshwater form occurring on rocks or among algal growths. It seems to prefer swift waters or rapids and is found in company with *Neritilia succinea* Récl. and *Neritina punctulata*

Lamarck. The author has gathered specimens of this species from algal covered rocks in the shallow rapids of the Rio Manjon, seven kilometers southeast of Puerto Plata, Santo Domingo. They exist under similar circumstances in the Cabaritta River, Jamaica, where they have been found in a strong fresh to slightly brackish current. Where there are no stones, they often occur on the stems of water plants. They are sometimes associated with freshwater sponges, blue-green algae, serpulid tubes and bivalves.

Specimens from the Great River Rapids, Jamaica, exhibit much corrosion and an extensive growth of calcareous algae. The animal was attempting to cover up the masses of these calcareous algae by depositing shelly material over them. Neritid egg capsules containing young specimens were found adhering to the shells which were collected in July 1932 by Andrews. These may have been the egg capsules of *Neritina punctulata* Lamarck, which was found at the same place at the same time, but the young within the capsules were too immature to be identified.

Range. United States: Florida — Tampa; Fort Lauderdale; Miami
Central America: Guatemala — Cavech River, Livingston
Greater Antilles: Cuba — Havana; Matanzas; Cienfuegos; Baracoa; Sabana la Mar
Santo Domingo — Rio Manjon, 7 km. S. E. of Puerto Plata
Jamaica — Lucea; Montego River, Montego; Fern Gully, St. Ann
Virgin Islands — St. Croix, Fair plain stream
Lesser Antilles: Guadeloupe — Basse Terre
Martinique — Fort de Franc
Tobago — Courland River

Neritina meleagris Lamarck

pl. 3, fig. 3, 4

Neritina meleagris Lamarck 1822, Anim. Sans Vert. **6**, p. 187.
Neritina pulchella W. S. Gray 1856, Index Test. Suppl. p. 232, pl. 8, fig. 18.
Theodoxus meleagris Lamarck, H. B. Baker 1923, p. 157, pl. 13, fig. 23.

Type locality, in rivers of Santo Domingo (Lamarck).

Description. Shell thin, globose, more so than *Neritina virginea* Linné. Color variable, consisting of many subtriangular spots varying in size, shape, number and arranged like imbricating scales with short, angular lines between them. These spots vary in color in different localities from a deep brown to olivaceous and to a bluish-grey to white. The "leading" or aperture edge of the spot is generally outlined with white, white and black, white and red, or white and tan. The "trailing" or spireward

margin of the spot is without the white or white combination color. The spots may occur in more or less irregular bands and are irregularly spaced. Between the spots are short, angular lines which are usually arranged as follows: black, white and tan; red, white and tan; black and tan; black and bluish grey, or merely white surrounding the tan or olivaceous spots. The angular lines may occur as bands of color on the shell. The spots usually take on a greyish cast where the bands are grey and a deeper yellow where the bands are red. The shell is thinly impregnated by pigment which scrapes off easily leaving a tan-bluish grey surface exposed. Whorls 3 to 3½, rounded in cross section. Spire low, rounded, occasionally slightly corroded, and cast at an angle of 127°. Aperture lunate, cast at an angle of 73° and slightly sinuous. Palatal lip rather long (not as long as *Neritina virginea* L) sharp, thin, bearing no teeth and colored bluish. Palatal hinge tooth weak. Parietal area smooth, convex, dirty yellow. Columellar edge bearing small irregular teeth varying in size and from about 4 to 10 in number. Suture faintly impressed. Periostracum thin, finely pitted. Sculpture consisting of many faint axial growth lines.

Operculum calcareous and blackish-grey with the exterior part bearing many faint lines of growth radiating from the nucleus. Periostracal layer along the palatal margin present. Peg and rib strong with the peg smooth.

Radula. R-central width approximately equal to length.

A-central rather longer for its width than typical and with very heavy rounded posterior lobe.

B-central typical.

C-central somewhat larger than typical.

D-lateral typical.

E-lateral typical but with somewhat larger and more rounded major inner cusp. The elliptical reflection bears about 17-20 distinct cusps.

Inner marginals with claw-like anterior portion and bearing 9-10 cusps. Middle marginals bearing 6-8 rather longer, more curved cusps arranged in a semicircular form. Outermost marginals appear to be typical but bear no denticles.

Measurements.	length	maximum width	minimum width	aperture length
Cuba: Punta de Los Colorados, Cienfuegos	8.7	9.1	6.1	7.8 mm.
Guatemala: Puerto Barrios	7.8	7.5	5.7	6.7
Nicaragua: Bluefields	8.0	8.1	5.3	7.2
Trinidad: Anse Trinquant	11.9	12.0	7.7	10.6
Brazil: Ceara	12.0	12.2	8.1	10.8

Remarks. Neritina meleagris Lamarck has been considered by some as belonging with the European and western Asiatic genus, *Theodoxus*. A comparison of *meleagris* with *T. fluviatilis* Linné, the type of *Theodoxus*, shows them to be quite different in shape. *N. meleagris* possesses a typical slate-colored *Neritina* operculum with a strong peg and rib, while *T. fluviatilis* has lost the peg and the operculum is white and the shape of the operculum of *T. fluviatilis* is more semicircular than that of *N. meleagris*. The color patterns vary. *N. meleagris* has the effect of imbricating scales with a white leading edge, usually arranged on a brownish-yellow background, while that of *T. fluviatilis* is made up, largely, of white spots irregularly arranged on a varied background of black, purple, or red. Ecologically, *Theodoxus* is a freshwater genus while *Neritina meleagris* is a brackish water form. For the above reasons I believe that *Neritina meleagris* Lamarck is not a *Theodoxus*.

This species has been considered a synonym of *N. virginea* by several authors, Tryon, p. 40 and v. Martens 1877, p. 123, but a comparison of a large series of both forms indicate them to be quite different. The range of *meleagris* falls within that of *virginea*, though the former is far more restricted.

No hybrid specimens have been seen between the two species.

Neritina meleagris Lamarck is a brackish water form found generally in mangrove swamps. It is of interest to note that, like *N. reclivata* Say, it does not occur on the Bahama Islands. Possibly these forms cannot live here because the Bahamas are composed of eolianite which is constantly being built up and broken down. Perhaps *N. meleagris* has never reached the Bahamas. We know too little of its ecology even to guess at the forces governing its relationship to its environment or its distribution.

Range. Central America: British Honduras — Belize
Guatemala — Puerto Barrios
Honduras — Puerto Cortes
Nicaragua — Bluefields
Costa Rica — Matina
Panama — San Blas

South America: Colombia — Cartegena; Brazil—Fortaleza; Parnahyba, Nova Almeida; Nictheroy; Santos; Sao Paulo

Greater Antilles: Cuba — Cayo La Salina, Caibarien; Cienfuegos Bay; Nuevitas
Haiti — Cap Haitien; Aquin; Port-au-Prince
Santo Domingo — Santa Barbara de Samana
Puerto Rico — Desecheo Island, Mayaguez

Virgin Islands — St. Thomas; St. Croix
Lesser Antilles: Barbadoes — Bridgetown
Trinidad — Anse Trinquant, 9 mi. N.W. of Port of Spain

Neritina piratica Russell

pl. 3, fig. 5, 6

Neritina piratica Russell 1940, Memorias de la Sociedad Cubana de Hist. Nat. **14**, no. 4, pp. 259–260, pl. 46, figs. 3, 4.

Type locality. Waunta Lagoon, Nicaragua.

Neritina listeri Sowerby 1855, in part, Thes. Conchy. **2**, p. 534, pl. 116, fig. 249 (not fig. 250-251), not *Nerita listeri* Pfeiffer 1840 (= *Neritina virginea* Linné) Weigmann's Arch. f. Naturg. p. 255; not *Nerita listeri* Récluz 1841 (= *Nerita fulgurans* Gmelin) Rev. Zool. p. 177.

Description. Shell globose and rather thick. Color brownish-yellow to olivaceous green with reddish brown or black zigzag axial lines forming a reticulated network over the shell. These lines break up the main color into triangular or diamond-shaped areas of lighter color which vary in size. The pattern scrapes off easily leaving a yellowish surface exposed. Whorls 2½-3, rounded in cross section. Spire rather low, often somewhat corroded, and cast at an angle of 117°. Aperture lunate and cast at an angle of 78°. It is slightly sinuous. Palatal lip rather long and sharp. It tends to be slightly marginate but bears no teeth. Palatal hinge tooth strong. Parietal area smooth, convex and dirty-yellow. The columellar edge bears very small irregular teeth. Suture faintly impressed and with a dark subsutural line. Periostracum thin. Sculpture consisting of faint axial lines of growth.

Operculum opaque, calcareous and slate-colored. Periostracal layer present along the palatal margin. Exterior bearing faint lines of growth radiating from the nucleus. Rib and peg strong. Peg smooth.

Radula. R-central wider than long.

A-central with large, rounded posterior lobe and long, narrow shank towards R-central.

B-central typical.

C-central typical.

D-lateral typical but with very much reduced outer projection of inner arm of Y-thickening.

E-lateral typical, bearing 12 rather coarse denticles on the anterior edge of the elliptical reflection. The major inner cusp is far more prominent than typical.

Inner marginals with claw-like anterior part bearing 8–9 denticles. Middle marginals bearing about the same number of longer, more curved ones arranged somewhat semicircularly. Outer marginals typical and bearing no teeth.

Measurements.

	length	maximum width	minimum width	aperture length
Guatemala: Cavech River	20.5	21.5	13.8	18.6 mm.
Nicaragua: Waunta Lagoon	17.8	18.4	12.9	15.2
Cuba: Zapata, Santa Clara Province	15.2	16.0	10.1	13.7
Santo Domingo: Sanchez	15.2	15.7	10.2	13.5
Venezuela: Porto Cabello	14.2	15.3	9.9	13.4

Location of holotype, M.C.Z. no. 115,702.

Remarks. Sowerby (Thes. Conchy. **2**, pp. 534–535, 1855) describes *Neritina listeri* and gives three figures of his species on pl. 116, figs. 249–251. There has been a confusion of species here, since two are represented by his figures. Figures 250 and 251 are without question *Neritina zebra* Bruguière. This leaves figure 249 without a name. As this figure is too poor to be designated as a type we have selected a holotype based upon a recently collected series, M.C.Z. No. 115,702, from Waunta Lagoon, Nicaragua.

This is a brackish water species inhabiting swampy areas. I am indebted to Doctor Elizabeth Deichmann, M.C.Z., for ecologic notes pertaining to this species. She found it on the stalks of brackish marsh grasses in the Caroni Swamp, Trinidad. The swamp was tidal with floating masses of fine, green algae. There were mangrove islands present and a muddy bottom. The water was shallow and became very warm at mid-day, under the tropical sun. It was filled with crustaceans to such a degree that it was almost soupy. The author has taken this species in brackish water at the head of Samana Bay, Santo Domingo, near the mouth of the Yuna River. Here also it was found on stranded logs and mangrove trunks above the mud and water.

Range. Central America: British Honduras — Belize
Guatemala — Cavech River, Livingston; Quirigua, Maya Farm
Honduras — Punta Patuca
Nicaragua — Waunta Lagoon; San Juan del Norte
South America: Venezuela — Rio Yaracuy, 45 km. N.W. of Puerto Cabello
Brazil — Parnahyba

Greater Antilles; Cuba — Rio San Juan and Rio Canimar, Matanzas Prov.; Zapata

Santo Domingo — Sanchez; Yuma

Lesser Antilles: Trinidad — Caroni Swamp

Neritina reclivata (Say)

pl. 3, fig. 7, 8

Natica reclivatus Say July 1822, Journ. Acad. Nat. Sci. Philadelphia, **2**, pt. 2, p. 257.

Neritina jamaicensis C. B. Adams 1851, Contrib. to Conch. **1**, p. 175.

Neritina reclivata sphaera Pilsbry 1931, Nautilus **45**, no. 2, pp. 67–68.

Type locality. St. John's River, Florida (Say).

Description. Shell globose and thin. Ground color deep purple brown, olivaceous green, grey or horny yellow with many fine, close angular, black, brown to lavender lines axially arranged. A subsutural black line follows the suture from spire to the tip of the aperture. Shell thinly impregnated by the pigment which scrapes off easily leaving a greenish-grey surface exposed. Whorls 2½, rounded in cross section. Spire very low to rather prominent, often more or less corroded and cast at an angle of 90°–115°. Aperture lunate cast at an angle of 81°. Palatal lip thin, sharp, slightly sinuous, long and bearing no teeth. Color white to bluish white. Palatal hinge tooth strong. Parietal area smooth, convex, bluish-white to dirty yellow and bearing a variable number of fine irregular teeth on the columellar edge. Suture faintly impressed. Periostracum thin. Sculpture consisting of many faint axial lines of growth.

Operculum opaque, calcareous and black to slightly brownish. Exterior bearing many fine lines of growth radiating from the nucleous. Peg and rib strong; peg smooth. Periostracal layer present along the palatal margin.

Radula. Specimens identified according to shells and opercula were *Neritina reclivata* Say M.C.Z. No. 100295. The radulae vary as follows:

Specimens from Hillsboro River, Tampa, Florida.

R-central square to rectangular.

A-central, central end of some teeth twice as wide as some others in the same radula. Lateral end varies from possessing a prominent posterior lobe to having merely a broadly rounded angle at that part of the tooth.

B-central typical.

C-central typical.

D-lateral typical but usually with very much reduced outer projection of inner arm of Y-thickening.

E-lateral typical in shape but bearing from 12–14 denticles in one radula and from 16–20 in another on the edge of the elliptical reflection and 34 in still another from Tampa.

Inner marginals with claw-like anterior portion and bearing 9–11 rather broad, curved, short denticles arranged chiefly on the anterior edge. These become longer and arranged in an oval as we progress laterally (see fig. 1). Anterior tips of marginals taken from a row of teeth and arranged from the innermost near the laterals on the left towards the outermost at the margin of the radula on the right.

Fig. 2. Reading from left to right are the inner middle and two of the outer marginals of *Neritina reclivata* Say.

Specimens from the Caloosahatchee River, Fort Myers, Fla. were identified by the opercula and shells as *Neritina reclivata* Say, M.C.Z. No. 56451. Radulae from this lot vary as follows:

R-central typical to narrow and rectangular.

A-central varying from longer and narrower than typical and with a reduced posterior lobe to shorter, broader and with larger to bluntly pointed posterior lobe than is typical. The position of the posterior lobe also varies from near the lateral end of the tooth to midway and ever slightly nearer the central end.

B-central typical.

C-central typical.

D-lateral typical.

E-lateral varies from those with a prominent major inner cusp to those in which it is but little more than one of the denticles on the anterior edge of the elliptical reflection. These denticles vary from

8–9 strong, rather blunt ones in one radula to 17–22 fine ones in another.

Inner marginals bearing about 10 rather blunt cusps as in fig. 2; middle marginals with 10–12 longer, curved and more pointed denticles as in fig. 2. Outermost marginals—some appear to bear 8–12 minute denticles while others do not appear to bear any but one of the type shown as fig. 2 No. 4 where the anterior tip of the tooth is curved over.

The above shows that there is considerable difference in the radula of a species from the same locality and from place to place. The specimens from these two Florida localities are particularly interesting, not only because there is great variation in the radulae in the individuals, but also because these colonies were pure with no other species with which to interbreed. For this reason these lots were selected for radula examination. If we wished to base our specific determinations on radula differences alone, we could make several new species from the individuals found at these two places. Other considerations such as the shell and operculum would not permit of such a division, however, and the author feels it far wiser to leave the species intact. Radula variations or similarities could be explained by a number of influences other than those of chromosomal change with the resultant species formation. For example, with individuals feeding upon the same type of food we should expect to find rather similar weapons of a rasping nature for the preparation for digestion. This is exactly what we do find. An examination was made of the radulae of members of widely separated molluscan families that are plant and lichen feeders. They are as follows: *Ccrionidae*, *Bulimulidae*, *Uricoptidae*, *Camaenidae*, and *Veronicellidae*. The localities that were selected for the individual specimens are widely separated. For example, *Ccpolis varians* Menke is from the Bahamas. *Crystallopsis tricolor* Pfeiffer is from the Solomon Islands. *Veronicella occidentalis* Gldg. comes from Jamaica. *Crystallopsis debilis* Clapp is reported from the Solomon Islands. *Ccrion incanum* Binney is from Upper Matecumbe Key, Florida. *Liguus fasciatus viridis* Clench comes from Soledad, Cienfuegos, Cuba, and *Urocoptis pruinosa* Morelet is from Sierra de Casas, Isla de Pinos, Cuba. There were also other members of the above families that were studied, but this list of species serves to cover the families examined. Most of these families are widely separated; some of them in both classification and actual distance. Nevertheless, they show a remarkable resemblance in the general type of radula they exhibit. They all possess square to rectangular teeth bearing a cusp or cusps. The teeth are placed in rows one next to

another and resemble tiers of blocks. The radula ribbon resembles a coat of chain mail. The teeth in any one radula are of one type — the block type — though they vary among themselves and from species to species. The significant point is that these widely separated species feeding upon similar food possess very similar weapons to deal with it. A parallelism of diet apparently tends to develop somewhat similar equipment for utilizing the material eaten. This is exactly what we should expect. It might be argued equally that since these species had a similar type of radula, they fed upon the same type of food. The significant point here is that certain types of radulae have been developed among the various groups of the mollusca.

Measurements.

	length	maximum width	minimum width	aperture length
Cuba: Zapata, Santa Clara Province	16.7	17.4	11.4	14.8 mm.
Florida: Caloosahatchee River, Fort Myers	17.2	16.8	10.8	14.0
Mexico	15.7	16.2	10.0	13.2
Nicaragua	16.0	15.4	10.3	14.0
Santo Domingo: Sanchez	17.4	17.4	11.1	14.5

The holotype is A.N.S.P. No. 37575.

Remarks. Neritina reclivata Say is a rather unique species and differs sufficiently from other axially striate rather elongate to low spired forms such as *Neritina cumingiana* Récluz or *N. roissayana* Récluz to be readily distinguishable. Though it becomes quite globose in Cuba, Hispaniola and Nicaragua, it never becomes as globose as *Neritina zebra* Bruguière, which is the only other comparable form which is axially striate, from the West Indian region. The more globose form, a golden yellow color and broader, more widely spaced black axial lines of *N. zebra*, separate it easily from *N. reclivata*.

A comparison of the ranges is equally interesting. *N. reclivata* Say occurs with certainty from Florida south to Panama and is found on certain of the larger West Indian islands (Cuba, Hispaniola, and Jamaica), where there are large freshwater rivers. *N. zebra* Brug. occurs in Venezuela and Brazil and, so far as known, does not inhabit the larger islands of the West Indies.

Specimens of *N. reclivata* from Cuba have been examined and it was found that there was a gradual gradation of color pattern between that of *Neritina virginea* and *N. reclivata*. Gradations of pattern from *N. reclivata* to *Neritina piratica* Russell have been noted also. An injury

to the shell of the former apparently sometimes tends to bring about a reticulation of the pattern and this grades into the less and then the more reticulated forms of the latter. *N. zebra* does not seem to grade into either *N. reclivata, N. virginea* or *N. piratica* though the last two are found within its range. Further investigation might disprove this, but specimens of *N. zebra* that I have examined do not seem to grade into these other forms. This leads to the speculation that possibly interbreeding takes place with the other three but that it does not take place with *N. zebra*. Nothing definite can be said in regard to this in the light of our present limited information.

Pilsbry, pp. 67–68 based his *N. reclivata sphaera* upon a lower spire, more globose form and relatively larger aperture than *N. reclivata*. Also the color of the variety is a grape green in contrast to the darker green of *N. reclivata*. An examination of Pilsbry's holotype (A.N.S.P. No. 154935) and two paratypes in the collection of the M.C.Z. No. (86377 and 83938) show that this form is not sufficiently different from true *N. reclivata* Say to be worthy of varietal rank. Pilsbry states that "in many hundreds of *N. reclivata* from many localities there are none having the globose shape, short spire and relatively large aperture of these shells." The globose form of *N. reclivata* is found chiefly on the larger West Indian islands. It is also known from other places in Florida and in Central America. We have seen specimens of this spherical form from the following localities:

M.C.Z. No. 132776 from Mobile, Alabama
" " 56451 " Caloosahatchee River, Fort Myers, Florida
" " 53028 " Tampa, Florida
" " 134224 " Palm River, Hillsboro Co., Florida
" " 104307 " Gulfport, Florida
" " 134222 " Livingston, Guatemala
" " 134223 " Creek West of Livingston, Guatemala
" " 135575 " Waunta Lagoon, Nicaragua.

The radula of *N. reclivata sphaera* could not be studied since none of the specimens possessed soft parts from which to extract it. The operculum is similar to that of *N. reclivata*.

Having seen Adams' cotype of *Neritina jamaicensis* in the collection of the U.S.N.M., the author believes that it is a synonym of *Neritina reclivata* Say. Also, specimens with a grey color have been observed in various museums. The lavender axial lines, however, seem to be limited to those specimens from the central block of West Indian islands as this character has not been observed elsewhere. Many of

the specimens bearing the lavender axial lines were old, much worn, and some stained with reddish earth. The cotype of *Neritina jamaicensis* Ads. bears the most brilliant axial lavender lines that the author has observed. It also is a much worn specimen, is rather small and globose with low, rounded spire, and lacking all columellar teeth. It possesses a lunate aperture, and does not vary much from specimens of *Neritina reclivata* Say. Since specimens of *Neritina reclivata* from Florida may possess a grey ground color and since true *N. reclivata* is found in Cuba and Santo Domingo, then the only observable difference between *N. reclivata* Say and *N. jamaicensis* Ads. is the presence of lavender, axial lines in the latter species. Such a difference is hardly worthy of even varietal rank and the author therefore believes that it should be made synonymous with *Neritina reclivata* Say.

Neritina reclivata Say is a brackish to freshwater species. It is found on any hard object in the water but not in mud. It is of interest to note with respect to its distribution that it occurs chiefly on those West Indian islands that are large enough to support permanent freshwater rivers and, apparently not further south than Santo Domingo or Puerto Rico. It has not, to my knowledge, been reported from Guadeloupe, the Barbados — islands that have permanent rivers. For what reason they are not found on these islands, I cannot say. It is possible that more extensive collecting might bring them to light here. This species is not found on the Bahama Islands. There are no permanent freshwater rivers on these islands. In Florida, *N. reclivata* is found on the stems of reeds and other water plants growing in the shallow water of drainage canals a few miles from the ocean. Apparently they feed upon many species of algae according to H. A. Pilsbry (*Nautilus* **45**, p. 68, 1932).

Range. United States: Florida — St. Augustine; West Palm Beach; Miami; Punta Rassa; Fort Myers; Tampa; Cedar Keys; Suwannee River; Gulfport; Pensacola
Alabama — Mobile; Bon Secour
Mississippi — Biloxi
Louisiana — Grand Isle; Shell Island; Marsh W. end of Rigolet Bridge
Texas: Port Arthur; Rockport; Corpus Christi
Central America: Mexico — Tampico; Vera Cruz
British Honduras — Belize
Guatemala — Cavech River, Livingston
Honduras — Puerto Cortes; Punta Patuca
Nicaragua — Waunta Lagoon; Bluefields; San Juan del Norte

Costa Rica — Limon
Panama — Puerto Bello
South America: Colombia — Maracaibo
Greater Antilles: Cuba — Rio Almendarez, Havana Province; Rio Canimar, Matanzas Province; Zapata; Manzanillo
Santo Domingo — Sanchez
Jamaica — Montego Bay; Port Antonio; Black River Bay
Lesser Antilles: Trinidad

Neritina zebra (Bruguière)

pl. 4, fig. 1, 2

Nerita zebra Bruguière 1792, Actes de la Soc. d'Hist. Nat. Paris, p. 126.
Neritina lineolata Lamarck 1822, Hist. Nat. Anim. Sans vert. 6, pt. 2, p. 186.
Nereina lacustris Cristofori & Jan 1832, Mantissa, Pt. 2, Cat. test. p. 4, sp. 31–18.

Type locality. Cayenne (French Guinea, South America (Bruguière).

Description. Shell globose and rather thick in adult specimens. Ground color yellow to reddish brown with fine widely spaced or thick zigzag axial black lines that are usually more or less parallel. A subsutural black line usually is present but not always. Black lines scrape off fairly easily leaving a chalky surface exposed. Whorls about 2 to 2½, rounded in cross section. Spire low, rounded and often considerably corroded, cast at an angle of 103°. Aperture lunate, slightly sinuous and cast at an angle of 80°. Palatal lip thin and sharp and is usually marginate. There is a low, rounded superior prominence on the margination. Palatal lip shorter in proportion to maximum width of the shell than in *Neritina virginea* L. and bears no teeth. Color grey to bluish-white. Palatal hinge tooth strong. Parietal area smooth, convex, chalky white to dirty yellow, bearing a variable number of fine dentations on the columellar edge. Suture faintly impressed. Periostracum thin. Sculpture consisting of many faint axial lines of growth.

Operculum calcareous, opaque, bluish-black. Exterior bearing many fine lines of growth radiating from the nucleus. Peg strong, smooth. Rib tends to be reduced. Periostracal layer present along the palatal margin.

Radula R-central width approximately equal to length — typical.
A-central typical. Some with more prominent posterior lobe than others.

B-central typical.

C-central with slightly more vertical ridge than typically.

D-lateral typical but with reduced outer projection of inner arm of Y-thickening.

E-lateral typical in shape and bearing 8–12 course denticles on the anterior edge of the elliptical reflection.

Inner marginals with long claw-like anterior part bearing 8–9 rather short pointed denticles. The middle marginals bear about 10–11 more curved and slender denticles than those of the inner marginals and are arranged semicircularly. The outermost marginals appear typical and uncusped.

Measurements.

	length	maximum width	minimum width	aperture length
Brazil: Bahia	20.0	21.4	14.1	17.7 mm.
Brazil:	13.7	14.4	9.5	12.6

Remarks. The genus *Nereina* was described by Cristofori and Jan with *N. lacustris* as its only species l.c. (1832). This we now consider to be the same as *Neritina zebra* Bruguière. As the name *Nereina* antidates *Vitta* Morch (1852) it will therefore have to replace this subgenus. As stated before, *N. zebra* is very closely related to *N. virginea* Linné, which is the type species for the subgenus *Vitta*. Therefore, *Nereina* C. and J. replaces *Vitta* Morch.

Neritina zebra is the most globose species occupying the West Indian region. It resembles *Neritina reclivata* Say most closely but may be distinguished from that species by its more globose form, more golden yellow to dark brownish red color, the comparatively shorter, wider palatal lip and the usually broader, more widely spaced axial lines. These lines tend to zigzag more with *Neritina zebra* than with *Neritina reclivata*. There are albinistic forms of *N. reclivata* occurring in Cuba that appear most like *Neritina zebra* since the lack of the usual olivaceous coloring of *N. reclivata* leaves the shell with a corn yellow color. The characters as given above, however, will distinguish these species.

Neritina zebra Brug. is a brackish to freshwater form occuring chiefly in Brazil. Beyond this, we know very little of its ecology.

Range. Central America: Honduras — Aguan

South America: Venezuela — Caracas; Pedernales; Curiapo

French Guiana — Cayenne

Brazil — Para; Bahia; Pernambuco; Itabapuana

Subgenus NERITINA s.s. Lamarck

NERITINA PUNCTULATA Lamarck

pl. 4, fig. 3, 4

Neritina punctulata Lamarck 1816, Encycl. Meth. **3**, pl. 455, fig. 2a–b, list p. 11 (n. and f.).

Type locality. Rio Grande, Port Antonio, Jamaica (Russell).

Description. Shell subpatelliform and thin. Ground color varies from a deep to a light brown or occasionally reddish pink. The ground color is either solid or made up of fine, close, zigzag axial lines. Sometimes there will be two or three broad bands of reddish pink alternating with one or two brown ones. Superimposed upon this background are many suboval, light yellowish brown spots. These are outlined on the "leading," aperture edge, by a heavy black line. The "trailing," spireward, edge is not thus outlined. Shell thinly impregnated by pigment which is usually no more than a thin, brownish layer punctulated by white spots. The pattern is carried mainly by the rather thick periostracum. Shell is bluish-white beneath the periostracum. Whorls 1¼ to 1½ rounded in cross section. Spire very low, rounded, and often much corroded leaving an irregular indentation. It is cast at an angle of 127°. Aperture lunate and cast at an angle of 76°. Palatal lip thin, sharp, and slightly sinuous. It is long, bearing no teeth and bluish-white. Palatal hinge tooth strong. Parietal area smooth and flat. Columellar edge bearing no teeth or very faint irregular ones. Columellar area white to dirty yellow. Suture faintly impressed. Sculpture consisting of many faint lines of growth axially arranged.

Operculum opaque, calcareous and pinkish white to salmon pink. Exterior bearing many fine lines of growth radiating from the nucleus. Peg prominent and smooth. Rib very prominent. Periostracal layer present along the palatal margin.

Radula. R-central almost square, slightly smaller at the anterior end, resembling a kernel of corn.

A-central broad with large, smoothly rounded posterior lobe which forms the whole lower corner of the tooth in that section.

B-central typical with "s"-shaped ridge.

C-central with ridge more vertical than normal.

D-lateral with a reduced outer projection of inner arm of Y-thickening.

E-lateral with large crescent-shaped elliptical reflection

which is sharply pointed on the edge towards the center. The lateral edge of the elliptical reflection bends sharply in the direction of the crescent forming a loop which fades into the posterior body of the tooth. This loop is characteristic of *Neritina punctulata*.

Inner marginals with large, claw-like anterior part which bears 14 short, blunt denticles on its anterior side. These denticles become curved, longer and placed in an oval formation on the teeth as we proceed laterally. The outermost marginals bear about 14 minute denticles.

Measurements.

	length	maximum width	minimum width	aperture length
Guadeloupe Id.: near St. Rose	19.6	20.2	10.2	20.1 mm.
Guatemala: Livingston, Cavech River	26.5	26.4	14.8	25.4
Jamaica	23.0	23.0	12.4	21.5
Puerto Rico: El Yunque, 20 mi. E. of San Juan	18.5	18.0	10.2	15.5

These specimens from the Cavech River, Guatemala, were not only unusually large, but had very heavy shells and were in general a lighter brown than usual.

Type locality here selected is Rio Grande, Port Antonio, Jamaica.

Remarks. The original locality is not given by Lamarck. The first locality appeared as Indies and Mollucas, when Deshayes synonymised Lamarck's species with *Neritina pulligera* L. in Encycl. Meth. **3**, p. 625, 1830–32. Deshayes refers to Lamarck's plate 455, fig. 2a-b. This is *Neritina punctulata* Lm., which is a valid species from the West Indies and should not have been synonymised. Since a type locality was not given by Lamarck, a type locality is here selected. It is Rio Grande, Port Antonio, Jamaica.

Neritina punctulata stands alone in regard to the relationship of size and shape among the species of the West Indian region. Its subpatelliform shape approaches that of *Smaragdia viridis* Linné and *Neritilia succinea* Récl., but it is far larger than either of these. It is similar in shape to *Neritina pulligera* Linné from the East Indies, yet this species is usually larger. *N. pulligera* has a flat to concave columellar area and slightly convex operculum which is relatively wider for its length than that of *N. punctulata*, and has a far greater relative distance between the strong rib and peg than has *N. punctulata*. Also, the color pattern of *N. punctulata*, which is made up of many light sub-

circular olivaceous spots on a brown to dark olive background, would prevent confusion of these two species. The color of *N. pulligera* is a solid deep brown over the entire shell with a red columellar area, as opposed to the dirty-orange to yellow columellar area of *N. punctulata*.

Those variants of *Neritina clenchi* Russell from Guadeloupe approach *N. punctulata* in shape somewhat but are more highly spired and more globose. Also, the interior of the aperture of *N. clenchi* is usually bluish-white, though sometimes it contains yellow similar to those specimens from Guadeloupe. The aperture is wider in proportion to its length in *N. punctulata*. The color patterns of some specimens of the two forms are rather similar but those from Guadeloupe are much darker brown. There has been some confusion in the past between *Neritina virginea* Linné and *N. punctulata* Lamarck, but the subpatelliform, low spired form of the latter should distinguish it immediately from the globose, rather higher spired shape of the former. *Neritina latissima* Broderip from the rivers of western Central America somewhat resembles *N. punctulata* in general shape and color pattern but the development of lateral wings on the palatal lip will distinguish these two species. Also the aperture of *N. latissima* is relatively wider in relation to its length than that of *N. punctulata*.

In the Man. Conch. 10, 1888, p. 60, it is stated that *N. punctulata* "probably inhabits the sea as well as fresh water." It is also stated that it occurs from Panama to Mazatlan, Mexico, on the west coast of Central America. I believe that there has been a confusion here of the two species *N. punctulata* from the West Indian region and *N. latissima* Broderip from the west coast of Central America for the following reasons:

1. Tryon, p. 60, p.l 20, fig. 41 makes *Neritina turbida* Morelet a synonym of *N. punctulata*. Lot M.C.Z. No. 21170 from Rio Lajas, Nicaragua, contains young specimens of *N. latissima* that are identical with Tryon's fig. 41. It is therefore here considered that *N. turbida* Morelet is a synonym of *N. latissima*.

2. On the same page as above *Neritina bahiensis* Récluz 1850, is synonymised with *N. punctulata*, and is reported from Bahia, Brasil. Récluz, in the above reference, p. 155, merely reports it as "Hab: Bahia (M. Janelle)". Récluz' figure and description leave no doubt in the author's mind that this is *N. latissima*. The reference to Bahia may be an error or it may not mean Bahia, Brazil. For example, there are many localities on the west coast of Central America that bear the name Bahia. Also, the Spanish word "bahia" means "bay" and possibly Récluz' reference to it as a locality merely meant that his speci-

mens were collected from a bay. The reason for assuming that Bahia, Brazil, is an error is that nothing similar to Récluz' species, *N. bahiensis* has been taken from Bahia, Brazil, since then.

In the Man. Conch. 1888, **10**, p. 60, *Neritina cassiculum* Sowerby is synonymised with *N. punctulata*. In the collection of the M.C.Z. are specimens from Mazatlan, Mexico, and Realejo Bay, Nicaragua, that are identical with Sowerby's figure. Since *N. punctulata* is a species from the West Indian region and not from the west coast of Central America, and since they are very different in shape and color pattern, I do not believe that *N. cassiculum* is a synonym of *N. punctulata*. Furthermore, *N. punctulata* is a freshwater species, while *N. cassiculum* is very probably a brackish to salt water form. *N. cassiculum* is here considered to be a valid species since it is quite different from any other of the *Neritinas* from the west coast of Central America.

N. punctulata is a freshwater species occurring on stones and boulders in moderately swift to rapid water. Localities of this type where specimens have been taken in Jamaica are the Great River Rapids, Flint River, and at "Mount Pleasant" in Hanover. This species is found in company with *N. clenchi* Russell and *Neritilia succinea* Récluz. It is interesting to note that the specimens of *N. punctulata* from the Cavech River, Guatemala, are much larger and have far thicker shells than those from any other locality from which the M.C.Z. possesses specimens. This may be due to a less acid condition of the water, a greater quantity of lime available for the formation of shells, or a very vigorous race of individuals. *Neritina piratica* Russell from the same locality reaches its largest size here, also, and possesses the thickest shells found for this species throughout its range. From the point of view of the relationship between the individual and its environment, these two species could be studied here to advantage.

Range. Central America; Mexico — Vera Cruz
Guatemala — Cavech River, Livingston
Nicaragua — Waunta Lagoon
Greater Antilles: Cuba — Baracoa
Haiti — Jeremie; Port de Paix
Santo Domingo — Yaguada, Cape San Rafael
Jamaica — Lucea; Montego Bay; St. Ann's Bay; Annotta Bay; Rio Grande, Port Antonio; Buff Bay River; Morant Point; Kingston
Puerto Rico — San Juan; El Yunque, 20 mi. E. of San Juan
Lesser Antilles: Guadeloupe — St. Rose
Dominica — Laudet
Martinique
Grenada

Genus Smaragdia Issel

Smaragdia viridis weyssei Russell

pl. 4, fig. 5, 6; pl. 7, fig. 2

Nerita viridis Linné 1758, [in part], Syst. Nat. ed. 10, p. 778.
Neritina (Smaragdia) viridis L., G. W. Tryon Jr., 1888, Man. Conch. **10**, pp. 54–55, pl. 18, fig. 88.
Smaragdia viridis Linné, H. B. Baker, 1923, Proc. Acad. Nat. Sci. Philadelphia **70**, pp. 173–174.
Smaragdia viridis weyssel Russell 1940, Mem. Soc. Cubana Hist. Nat. **14**, p. 257, pl. 46, fig. 5–6.

Type locality. Miami, Florida.

Description. Shell subpatelliform and thin. Color grass green, with irregular white spots varying in shape, size and number. Shell thinly impregnated by pigment. Pattern scrapes off easily leaving a green

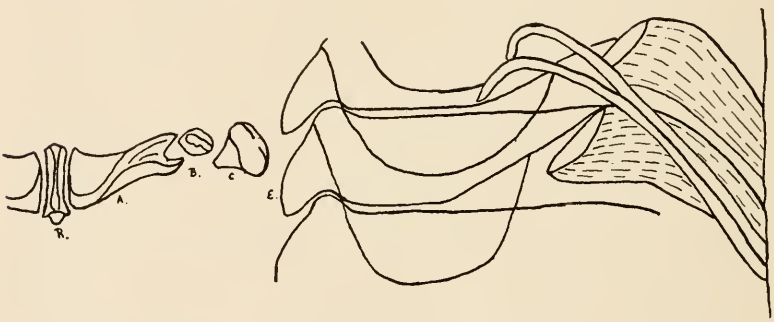

Fig. 3. Right half of a radula row of *Smaragdia viridis weyssei* Russell. R-central, A-central, B-central, C-central, E-lateral, broad inner and slender outer marginals.

surface exposed. Whorls 1¼–1½ and rounded in cross section. Spire very low, rounded, not corroded and cast at an angle of 138°. Aperture lunate and cast at an angle of 76°, very slightly sinuous. Palatal lip long, sharp, thin and bearing no teeth. Palatal hinge tooth faint to lacking. Parietal area convex, smooth and whitish-green; columellar edge bearing 6–8 small, irregular teeth. Suture faintly impressed. Periostracum thin, very finely pitted. Sculpture consisting of many faint axial lines of growth.

Operculum opaque, calcareous and greenish-white. Periostracal

layer present along the palatal margin. Exterior bearing many faint lines of growth radiating from the nucleus. Rib and peg strong. Peg smooth.

I have been unable to locate the denticles on the marginals that Baker mentions on p. 174, nor do I find any on the E-lateral that he mentions on p. 173. The edge of the elliptical reflection bears no denticles in the seven complete radulae examined under high and low powers of the microscope.

Measurements.	length	maximum width	minimum width	aperture length
Florida — Miami	5.1	5.2	2.6	4.9 mm.
West Indies — Barbados	5.7	6.0	2.8	5.2
Virgin Ids., Guana Id., Tortola	4.8	5.1	2.6	4.1

Location of type M.C.Z. No. 88815.

Remarks. Linné in his Syst. Nat. ed. 10, p. 778, 1758, bases his description of *Nerita viridis* upon and refers to the work of Patrick Brown, "The Civil and Natural History of Jamaica," Pt. 2, p. 399, 1756. Linné does not refer to any work containing figures of his species. He describes it as coming from the Balearic Islands, Mediterranean Sea, and Jamaica, West Indies. There appear to be certain constant differences between the forms from these localities. Since Linné based his description upon specimens from these two localities, it leaves the matter open as to which name shall be employed for these two forms. It is proposed here to use the name *Smaragdia viridis* L. for the European form and limit *S. viridis weyssei* to the western Atlantic region. The European form possesses solid black axial, more or less parallel lines on the whorls. Whether the specimen be young or old, these lines are found on almost 100% of the specimens. These narrow lines are located on the spireward or "trailing" edge of the white spots. The West Indian form never possesses these solid black lines, but rather, when present, a brownish-red "trailing" edge to the white spots. Also, these brownish-red edges occur in only from 3–15% of the specimens from any one lot and seem to be linked with the age of the specimen in some way since no adults could be found that possessed them. It is interesting to note according to Woodring, p. 427, that the fossil forms that have been found in the Cercado formation of the Dominican Republic may indicate that the West Indian and European forms may have been the same during the Middle Miocene, but the living one from the West Indies possesses differences that mark it off very definitely from the European. Therefore it is

felt to be wiser to keep the West Indian form as a variety of the European rather than raise it to specific rank.

Smaragdia viridis weyssei is a saltwater species living on eel grass and under broken rocks. The author has collected it alive on several West Indian islands, but never abundantly at any one place. It is an easily recognizable species and cannot be confused with any other of the West Indian forms. For this reason it would make an excellent one for ecologic or distributional studies. It also seems to have no other forms with which to interbreed and must, therefore, be a comparatively pure strain.

Range. (see pl. 7, fig. 2). The range extends from Palm Beach, Florida, and the Bermudas through the West Indian islands as far south as Bonaire. It has also been reported from Vera Cruz, Mexico, Progreso, Yucatan and Belize, British Honduras, Central America. No records from South America have been seen.

Genus Neritilia von Martens

Neritilia succinea (Récluz)

pl. 4, fig. 7, 8

Nerita suecinea Récluz, 1841, Rev. Zool. **77**, p. 343.

Nerita pygmaea C. B. Adams 1845, Proc. Bost. Soc. Nat. Hist. **2**, p. 7.

Neritina succinea Récluz, v. Martens 1879, Conchy. Cab. **2**, pt. 10, pp. 242–243, pl. 23, fig. 23, 24.

Neritilia suecinea Récluz, Tryon 1888, Man. Conch. **10**, p. 54, pl. 17, fig. 83; H. B. Baker 1923, Proc. Acad. Nat. Sci. Philadelphia, **75**, p. 172, pl. 16, fig. 41.

Neritilia succinea guatemalensis Pilsbry 1919, Proc. Acad. Sci. Philadelphia **70**, p. 172.

Type locality. Madagascar and Guadeloupe (Récluz).

Description. Shell subpatelliform, thin, and uniformly horn colored. Color deeply impregnated in shell which does not scrape off. Whorls 2¼ to 2½, rounded in cross section. Spire very low, rounded, not corroded and cast at an angle of 152°. Aperture lunate, slightly sinuous and cast at an angle of 90°. Palatal lip long, sharp, thin, and bearing no teeth. Palatal hinge tooth lacking. Parietal area smooth, flat to slightly convex, bluish-white to horn colored. Columellar edge bearing no teeth. Suture very faintly impressed. Periostracum lacking. Sculpture consisting of many very faint axial growth lines.

Operculum calcareous, white to horn colored. Periostracal layer

present along the palatal margin. Exterior of operculum with many fine concentric lines of growth. Inner side bearing a ridge on the parietal margin and basal third of the palatal edge. This ridge rises to form a smooth, prominent peg at the inferior palatoparietal junction. There is a horizontal "V"-shaped depression at the base of the superior palato-parietal junction. The angle of the "V" points in the direction of the peg.

Fig. 4. Radula teeth from a row in the left half of the radula of *Neritilia succinea* Récluz. The R-central is lacking. A-B-C-centrals together, B-central, C-central, E-laterl, an inner and one of the outer marginals.

The teeth of the radula of *Neritilia succinea* Récl. are very similar to those of *Neritilia rubida* Pease as given by Baker, pl. 16, fig. 42. *N. rubida* is an East Indian species, while *N. succinea* is a West Indian one, yet their radulae are surprisingly alike. There is little more difference than one would expect to find between the individuals of a species. The number of denticles on the E-lateral vary slightly and the B and C centrals vary in shape somewhat also, but, in general, the two are remarkably similar.

Measurements.

	length	maximum width	minimum width	aperture length
Jamaica: Great River Rapids	5.3	5.7	2.9	4.4 mm.
Hispaniola: Mouth of Sosua River, Puerto Sosua	4.6	5.2	2.7	4.4
Guadeloupe Id.	4.0	4.4	2.5	3.8

Neritilia succinea has not been reported from Madagascar since Récluz described it from there in 1841. He also reported it from Guadeloupe. We have records which show that this species exists in the West Indian Region. Therefore, the latter locality is here considered to be the correct one.

Remarks. Neritilia succinea Récl. is closely allied to *N. rubida* Pease and *N. manoeli* Dohrn from the East Indies and Princes Island, Gulf of Guinea. It differs from *N. rubida* in possessing a somewhat smaller callous, a larger palatal lip and the peg of the operculum is usually much more pronounced. The size of the two is about equal and the radulae are very similar. There is greater difference between *N. succinea* and *N. manoeli* from across the Atlantic Ocean than there is between *N. succinea* and *N. rubida* from the Pacific Islands. *N. manoeli* is a very much smaller species, attaining only about ¼ the size of *N. succinea* and with a much reduced peg on the operculum.

Récluz distinguishes *N. succinea* from *Smaragdia viridis* and *S. rangiana* Récl. as follows: This species (*N. succinea*) cannot be confused with *Nerita* (*Smaragdia*) *viridis* L. and *Nerita* (*Smaragdia*) *rangiana* Récl. because it is deprived of color spots and crenulations at the edge of the columellar area. Also in general these two species are larger.

Pilsbry's holotype of *Neritilia succinea guatemalensis* proves on examination to be *N. succinea* Récluz. Pilsbry's variety is, therefore, here synonymised with it as above.

Neritilia succinea Récl. is a freshwater species inhabiting streams both swift and slowly flowing. It is found on rocks among algal tufts in company with *Neritina clenchi* and *Neritina punctulata*. Specimens sent to the M.C.Z. by Prof. E. A. Andrews carried a limy algal deposit covering the shell. The author has found specimens of this species clinging to rocks in a small stream at the mouth of the Sosua River on the north coast of Santo Domingo.

Range. Central America: Guatemala — Livingston

Greater Antilles: Haiti — Jeremie, Coteau; Aux Cayes; Port-au-Prince

Santo Domingo — Little stream, mouth of Sosua River, Puerto Sosua

Jamaica — Great River Rapids and Flint River, near Montego Bay; Mount Pleasant near Kingston

Guadeloupe Island

SPURIOUS WESTERN ATLANTIC NERITIDAE

Lepyrium showalteri (Lea)

Neritina showalteri Lea 1861, Proc. Acad. Nat. Sci. Philadelphia **13**, p. 55; Tryon 1888, Man. Conch. **10**, p. 53, pl. 17, fig. 81, 82.
Lepyrium showalteri Dall 1896, Nautilus **10**, pp. 13–15.
Lepyrium showalteri cahawbaensis Pilsbry 1906, Nautilus **20**, p. 51.

As indicated above, this species was described as a Neritina, but the horny operculum, and the radula place it with the family Hydrobiidae.

The type locality for this species is the Coosa River above Fort William, Alabama. It has not been reported since from that locality and it is very possible that there is an error in Showalter's record. The reasons for believing this, are that we possess several records of *Lepyrium showalteri* from the Cahawba River, Alabama, A. A. Hinkley and Smith did not find it in the Coosa River and though as careful a collector as R. E. Call collected in both these rivers he only found it in the former. Dr. Henry Vander Schalie of the Museum of Zoology, Ann Arbor, Michigan, and Mr. W. J. Clench of the Museum of Comparative Zoology, at Harvard University, found it at Lily Shoals, Cahawba River and not in the Coosa River. It is, therefore, reasonably certain that the Cahawba River is the correct locality.

Lepyrium showalteri Lea has been discussed by the above authors. It is considered to be a Neritina by Lea. This cannot be, for the reasons given above. Tryon p. 53 states, "It has been suggested that this is a young *Anculosa*, but it has not the characters of that group; on the contrary, it more nearly approaches in general *Neritina crepidularia*. The coloring of the epidermis more nearly resembles *Anculosa* however than the other fluviatile species of Neritina." Tryon's figure no. 79, pl. 17 representing *Lepyrium showalteri*, however, neither by shape nor color markings is this form, but rather very probably *Theodoxus fluviatilis* Linné.

Dall, Nautilus 1896, **10**, p. 15, states, "The Oligocene of Southern United States contains several species of Neritina, but none, so far as known, having a close resemblance to *Lepyrium*, which is, however, probably an offshoot from *Neritina*."

Thus far Lepyrium remains a part of, or very closely allied to the genus Neritina.

Pilsbry's subspecies, *Lepyrium showalteri cahawbaensis*, I believe to be a synonym of *Lepyrium showalteri* Lea, based upon immature specimens. This would explain the smaller size, the "straighter columellar edge" and the lack of "a raised outer margin of the columellar area" upon which Pilsbry based his variety.

From what has been stated above it is obvious that *Lepyrium showalteri* Lea is not a Neritina. The author believes that it is closely allied to the Hydrobiidae, though there are marked radular differences.

Neritina reclivata palmae Dall

Neritina reclivata palmae Dall 1885, Proc. United States Nat. Mus. p. 259, **8**, no. 17.

An examination of Dall's type specimen of *N. reclivata palmae* proves it to be *Neritina turrita* Gmelin of the East Indies. The specimen was supposedly collected in a brook near Palma Sola, Florida. Very likely a mixture of specimens had taken place, causing Dall's error.

Neritina jayana Récluz

Neritina jayana Récluz 1850, Journ. Conch. I, pp. 157–158, pl. 7, fig. 13. Récluz states in his description of this species, that it is from Dr. Jay of New York and that it cannot be confused with *Neritina* (*Theodoxus*) *fluviatilis* Linné of Europe because its coloration is constant, the spire is conical and the suture channelled. It is reported from North America by Récluz. M.C.Z. lot 56628 contains specimens of *Theodoxus fluviatilis* from Birmingham, England. These possess a color pattern similar to that given by Récluz in his figure pl. 7, fig. 13. They are about the same size as his hair line for it and have an elevated, conical spire. Some have a channelled suture. I agree with Tryon, p. 53, that *Neritina jayana* is doubtfully ascribed to North America and that it is an Old World species, but I go even further than this and believe that it is a *Theodoxus* and very probably *T. fluviatilis* which is a very variable species as to color pattern and form.

Neritina reclivata striolata von Martens

Neritina reclivata striolata von Martens 1877, Conchy.-Cab **2**, pt. 10, p. 120, pl. 13, fig. 12 proves, on examination, to be a synonym of *Neritina smithi* Sowerby and not a synonym of *Neritina reclivata* Say as it is made by von Martens.

Neritina cassiculum Sowerby

Neritina cassiculum Sowerby 1836, Conch. Ill, fig. 55 under section "Neritina".

Though *N. cassiculum* has previously been considered (Man. Conch. **10**, p. 60, 1888), a synonym of *N. punctulata* Lamarck, it is here considered to be valid and of specific rank for the following reasons:

Its closest relative among the species of the west coast of Central America is *N. latissima* Broderip, which it resembles only in the very young stages. The color patterns are practically identical being composed of lighter brown, suboval spots upon a darker background. These spots are enclosed by brown or black angular lines. Some specimens are banded with two or three alternating stripes of reddish-orange and dark brown. Here the resemblance ceases. *N. cassiculum* is a globose species, usually much smaller than *N. latissima*, *N. latissima* is not globose, but subpatelliform and rather thin shelled where *N. cassiculum* is comparatively thick-shelled. The opercula vary also. That of *N. latissima* is usually black and rather long for its width as compared with the brownish-white, operculum of *N. cassiculum* which is rather thick and wide for its length. Also the latter does not possess the wide aperture, the sides of which develop wing-like enlargements such as is the case with the former.

Note concerning Nerita ascensionensis Gmelin

According to von Ihering, p. 534, *Nerita ascensionensis* occurs on Fernando Noronha island about two hundred miles off the coast of Brazil. As yet we have no evidence that this species has reached continental America. I have not seen specimens of this species from Fernando Noronha.

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EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1 & 2. *Nerita peloronta* Linné (Nat. size).
Fig. 3 & 4. *Nerita versicolor* Gmelin (Nat. size).
Fig. 5 & 6. *Nerita fulgurans* Gmelin (Nat. size).
Fig. 7 & 8. *Nerita tessellata* Gmelin (Nat. size).

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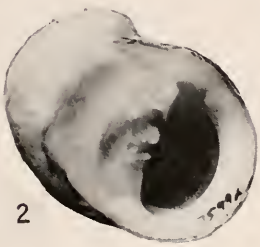

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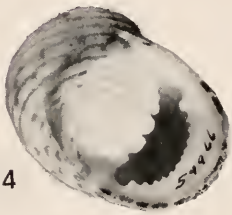

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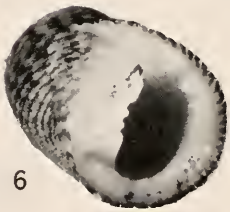

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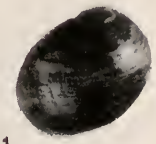
PLATE 2

PLATE 2

Fig. 1 & 2. *Fluvinerita tenebricosa* C. B. Adams (2x).
Fig. 3 & 4. *Puperita pupa* Linné (2x).
Fig. 5 & 6. *Puperita tristis* D'Orbigny (2x).
Fig. 7 & 8. *Neritina virginea* Linné (Nat. size).



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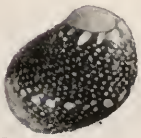

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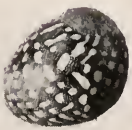

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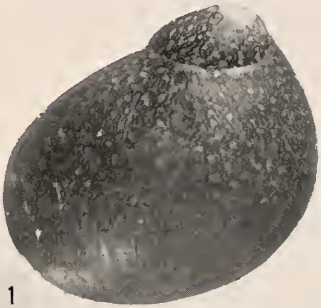
PLATE 3

PLATE 3

Fig. 1 & 2. *Neritina clenchi* Russell, holotype (2x).
Fig. 3 & 4. *Neritina meleagris* Lamarck (2x).
Fig. 5 & 6. *Neritina piratica* Russell, holotype (2x).
Fig. 7 & 8. *Neritina reclivata* Say (Nat. size).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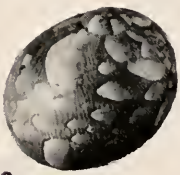
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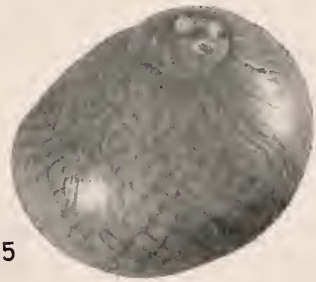
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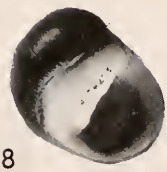
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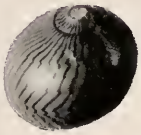
PLATE 4

PLATE 4

Fig. 1 & 2. *Neritina zebra* Bruguière (Nat. size).
Fig. 3 & 4. *Neritina punctulata* Lamarck (Nat. size).
Fig. 5 & 6. *Smaragdia viridis weyssei* Russell, holotype (6x).
Fig. 7 & 8. *Neritilia succinea* Récluz (4x).



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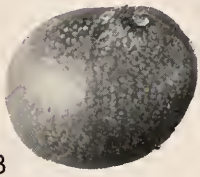

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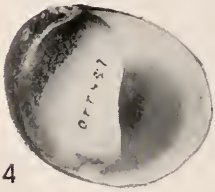

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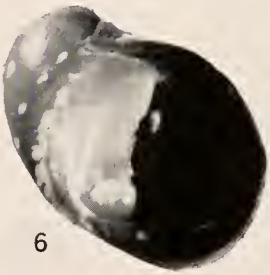

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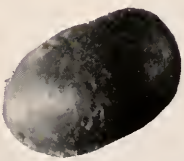

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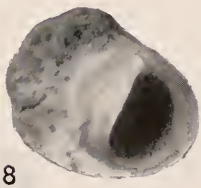

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PLATE 5

PLATE 5

DISTRIBUTION MAPS

Fig. 1. *Nerita peloronta* Linné.
Fig. 2. *Nerita versicolor* Gmelin.

TRINIDAD
TOBAGO
DE SÃO ROQUE
0 MILES 500
WEST INDIAN REGION
0 MILES 500

Fig. 1

TRINIDAD
TOBAGO
DE SÃO ROQUE
0 MILES 500
WEST INDIAN REGION
0 MILES 500

Fig. 2

PLATE 6

PLATE 6

DISTRIBUTION MAPS

Fig. 1. *Nerita fulgurans* Gmelin.
Fig. 2. *Nerita tessellata* Gmelin.

TRINIDAD TO C DE SÃO ROQUE
0 MILES 500
WEST INDIAN REGION
0 MILES 500

Fig. 1

TRINIDAD TO C DE SÃO ROQUE
0 MILES 500
WEST INDIAN REGION
0 MILES 500

Fig. 2

PLATE 7

PLATE 7

DISTRIBUTION MAPS

Fig. 1. *Neritina virginea* Linné.
Fig. 2. *Smaragdia viridis weyssei* Russell.

TRINIDAD
TOCDE SÃO ROQUE
0 MILES 300
WEST INDIAN REGION
0 MILES 300

Fig. 1

TRINIDAD
TOCDE SÃO ROQUE
0 MILES 300
WEST INDIAN REGION
0 MILES 300

Fig. 2

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THE CRANIAL ANATOMY OF ERYOPS MEGACEPHALUS

By H. J. SAWIN

WITH TWELVE PLATES

CAMBRIDGE, MASS., U. S. A.
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SEPTEMBER, 1941

No. 5—*The Cranial Anatomy of Eryops Megacephalus*[1]

By H. J. Sawin

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INTRODUCTION

Eryops megacephalus, occupying a central position in the Rachitomous group of amphibia, is an important representative of the Permocarboniferous labyrinthodonts. It is an extremely abundant fossil in the redbeds of Texas and hence is frequently encountered in the larger museum collections. Many investigators have been attracted to this easily available amphibian and, as is shown here, numerous descriptions of the skull or braincase have appeared in the literature. Unfortunately these descriptions, although of great value, are in many respects incomplete or inaccurate and consequently there is a lack of agreement regarding a number of morphologically important skull structures. It is the aim of this study to present a revision of the cranial anatomy of this animal based on material which has been prepared by modern methods with the hope that the results will be of use to students of early tetrapods. It is believed that the fairly completely ossified skull of *Eryops* will provide a more sound basis for the restoration of the nervous and vascular systems than the more

[1] Published with the aid of a special gift from Mr. George R. Agassiz.

chondrified skulls of *Lyrocephalus* (Soderbergh, '36) or *Benthosuchus* (Bystrow, '39).

Eryops megacephalus was first described by Cope (1877). An excellent figure of the skull of the type specimen in a volume of Cope's plates was edited and published by Matthew ('15). The first attempt at an analysis of the dermal elements of the skull was made by Broili (1899); Branson ('05) and Case ('11) continued this task, the latter investigator determining many of the relationships of the bones of the palate. Broom ('13) first correctly determined the position of the dermal bones of the entire skull, describing the braincase as well. Von Huene ('13) pioneered in the study of the braincase and cranial foramina. Watson ('16) provided much accurate information concerning the cranial morphology of this animal and later ('19) discussed *Eryops* in his important study on the evolutionary trends among the Rhachitomi and Stereospondyli. Williston ('18) critically reviewed the conclusions of previous workers on the morphology of the braincase and presented a separate analysis based on newly prepared specimens. Sushkin ('27) in a general discussion of the palatoquadrate and stapes included pertinent data concerning various structures of the cranium of *Eryops*. More recently Dempster ('35) reinterpreted the braincase and, by means of a series of endocranial casts, in part determined the relationships of the brain and inner ear. Muscles of the jaws have been restored by Adams ('19), while Miner ('25) and Olson ('36) have restored other portions of the muscular system which impinge on the skull.

This work has been conducted under the supervision of Professor Alfred S. Romer, for whose aid and encouragement I am extremely grateful. I am indebted to Mr. L. I. Price for his indispensable aid in the preparation of the illustrations. The many favors granted by the staff of the American Museum of Natural History are to be acknowledged, particularly on the part of Professor W. K. Gregory and Dr. Barnum Brown. I also here wish to thank Dr. E. C. Olson of the University of Chicago for the loan of a valuable specimen. The preparation of the sections was achieved by means of apparatus provided by the Elizabeth Thompson Science Fund.

MATERIALS AND METHODS

A number of the specimens prepared especially for this study were collected by expeditions of the Museum of Comparative Zoology at Harvard College in the Wichita Group of the Permo-Carboniferous Red Beds of Texas; these and most of the other specimens used as reference material were found in the Belle Plains formation of that

Group. As a supplement to these, the collections of the American Museum of Natural History were examined and one braincase from the collections of the Walker Museum of the University of Chicago was studied. The separate specimens are listed as follows with details concerning their collection and mode of preparation:

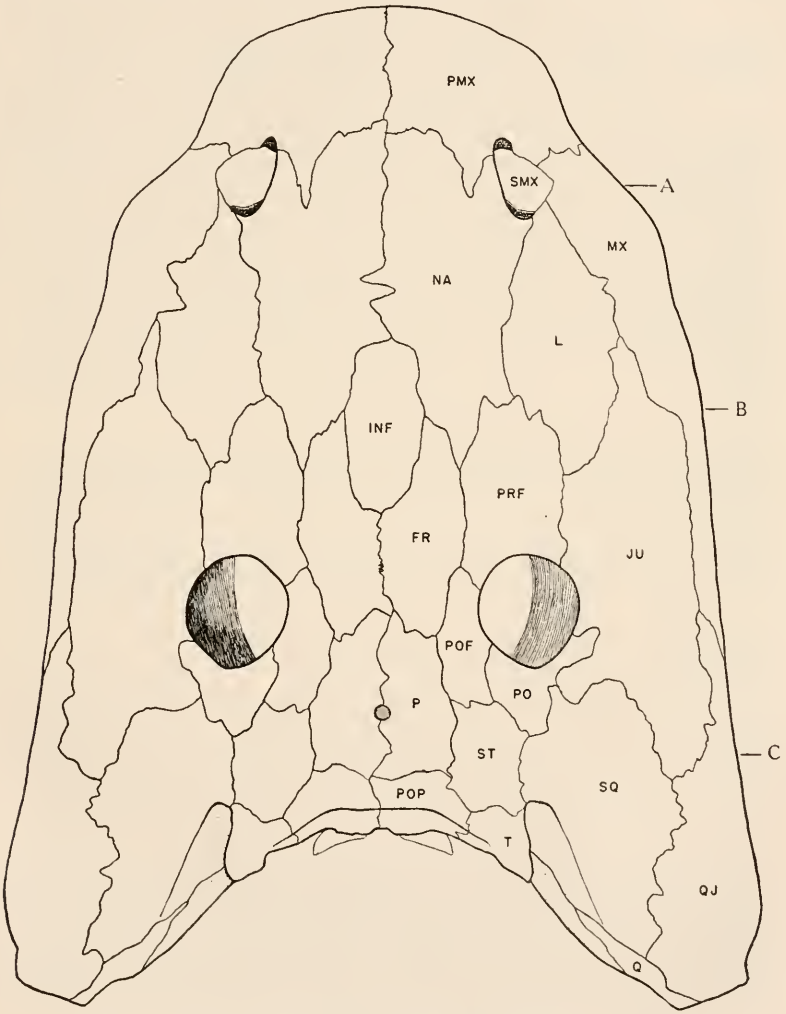

Fig. 1. *Eryops megacephalus.* Skull in dorsal view. x 3/10.

M. C. Z.[1] No. 1129. ERYOPS MEGACEPHALUS

Collected by L. I. Price during the summer of 1934 at a locality northeast of the Woodrum ranch-house in Archer County, Texas. This is in the Wichita Group, the Belle Plains Formation.

Measured in Centimeters	4186*	4175*	4184*	4180*	M. C. Z. 1129	Type specimen 4189*	4183*	4190*	4185*
Length of cranium from extremity of quadrate	52.5	48.6	46.8	45.0?	43.7	43.3	42.2	41.2?	38.6
Length of cranium along midline	44.0	39.3	40.5	35.8	36.4	33.5	35.6	34.6	30.7
Length from end of muzzle to nostril		9.5?	7.3	7.9	7.8	7.3	8.9	7.6	7.2?
Width of cranium between quadrates	42.5	35.0?	33.0?	29.5?	31.9	30.6	30.2?	30.5?	25.9
Width between orbits	11.0	9.1	9.7	9.0	8.2	8.6	8.2?	9.0?	7.0
Diameter of orbits anteroposteriorly		5.2	5.0	5.1	5.0	4.8	?	4.8	4.8
Diameter of orbits transversely		4 9	5.8	5.6	5.8	5.7	?	5.2	3.4?

* American Museum of Natural History.

This specimen consist of an excellently preserved skull with one ramus of the mandible missing. The descriptions are based on this skull with the exception of those concerning certain portions of the braincase. A comparative series of measurements shows that this skull conforms closely in dimensions with the type skull as described

[1] Museum of Comparative Zoölogy at Harvard College.

by Cope (1877). Corresponding measurements taken from other entire skulls indicate that M. C. Z. No. 1129 might be described as a young adult. This diagnosis is indicated also by the state of ossification of the skull, the specimen being less well ossified in certain regions than in the corresponding regions of the skulls of larger specimens. This lack of ossification, however, is slight and does not interfere with the interpretation of the fundamental structural relationships.

The preparation of this specimen was done by means of dental apparatus, a standard dental engine and heavy carborundum drills being used for the removal of the superficial matrix. This device was supplemented by hand and mechanical chisels for the coarser work. Two to 4% phosphoric acid solutions were found to be useful in corroding away the more superficial matrix, the action of the acid being carefully controlled by protecting the exposed areas of bone with a thin coating of cellulose acetate. The braincase required special treatment: the entire preparation was carried on under a binocular microscope with delicate hand chisels or a high speed hand drill with small carborundum points. Casts of the endocranial cavities were made of plasticine and vulcanized latex.

M. C. Z. No. 1407. Eryops sp.

Collected by H. J. Sawin near Electra, Texas, on the east side of Rough Creek. This locality is in the Clyde Formation of the Clear Fork Group.

A horizontally cracked sphenethmoid of this specimen clearly reveals the channels in that bone.

M. C. Z. No. 1458. Eryops megacephalus

Collected by R. V. Witter and party at Slippery Creek, Archer County, Texas. Wichita Group; Belle Plains Formation.

Serial sections were made from the braincase of this specimen employing the parlodian peel technique. The posterior portion of the skull was divided near the sagittal plane; one half was sectioned longitudinally at half millimeter intervals, the other half transversely at millimeter intervals. The anterior portion of the basisphenoid and the entire sphenethmoid were sectioned as a separate unit transversely. The posterior portion of this mass was sectioned at half millimeter intervals in the region of the basisphenoid and at millimeter intervals along the sphenethmoid. Casts of these parts were used for the orientation of the sections. The "peels" containing the sections were

stained in 2% methylene blue, by which process the bone is clearly differentiated from the matrix, the latter taking the stain more deeply. These sections served as a basis for wax plate reconstructions of parts of the braincase and endocranial cavities.

M. C. Z. No. 1553. Eryops sp., probably megacephalus

Collected by L. I. Price at a locality one and one-half miles northwest of the Woodrum ranch-house in Archer County, Texas. Wichita Group; Belle Plains Formation.

One half of this specimen, which consists of the posterior portion of the braincase, was sectioned in the sagittal plane at millimeter intervals. This was used as a check on the other sectioned material.

M. C. Z. No. 1651. Eryops sp.

Collected by L. I. Price, west of C. Williams' ranch in Archer County, Texas, Wichita Group; Belle Plains Formation.

This fragment of the skull is naturally eroded and clearly shows details in the region of the sella turcica.

M. C. Z. Nos. 1213, 1214, 1223, 1447. Eryops sp.

Collected by T. E. White and L. I. Price in the Putnam, Admiral, and Belle Plains Formations of the Wichita Group.

These specimens consist of various fragments of the braincase which have been cleaned by natural agencies and show certain details which are lacking or obscure in the more complete skulls.

Walker Museum No. 1260. Eryops sp.

Briar Creek, Archer County, Texas. Admiral Formation; Wichita Group.

This specimen, which consists of the posterior end of a skull, was figured by Williston ('18) and Sushkin ('27). The stapes is complete and in position, although somewhat displaced due to crushing.

GENERAL FEATURES OF THE SKULL

The skull is broad and moderately flat. The greatest length is 43.7 cm. from the muzzle to a line between the quadrates; the greatest width, found in the region of the quadratojugals, is 34 cm. The greatest height of the skull without the mandibles is 11.3 cm., this

last measurement being taken from parallel lines projected from the tops of the orbits and the tips of the descending flanges of the pterygoids. The ratio of length to width is therefore 1.28+ while the ratio of height to width is .33+. In lateral view (Plate 4) and particularly in sagittal section (Text fig. 2) the flat character of the skull is apparent.

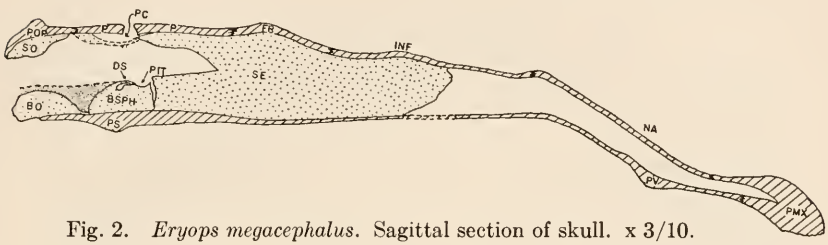

Fig. 2. *Eryops megacephalus*. Sagittal section of skull. x 3/10.

A dorsal view (Text fig. 1,[1] Plate 1) shows the general outline of the skull which decreases but slightly in width from back to front until the region about the nares is reached. There a slight indentation is seen in back of the nares and the muzzle is constricted in front of the nares, the anterior portion of the muzzle ending bluntly. There is a noticeable emargination at the widest portion of the skull, here bounded by the quadratojugals. The quadrates and associated dermal bones extend well behind and lateral to the occiput. Also prominent in this view are the openings for the nares, orbits, and the median parietal organ. The naris, largely closed by the septomaxillary bone, is 3.6 cm. long and 2.6 cm. high. Facing dorsolaterally, the orbits measure 5.0 cm. from front to back and 5.8 cm. in width. These are posteriorly placed, the distance between them and the nares indicating that the region of "intensive growth" of the skull occurred anteriorly between the orbits and nares. In general *Eryops* appears to resemble *Cyclotosaurus* as described by Bystrow ('35) in its regions of secondary skull growth, the elongation of the skull occurring in but one area as noted above. The median parietal foramen is situated somewhat behind a line across the posterior rims of the orbits and is 0.5 cm. in diameter.

An inspection of the contours of the skull roof (Plate 1) demonstrates that a somewhat horizontal skull table may be recognized in contrast to the sloping lateral walls; this rather flat dorsal area extends on to the rostral region where it is altered by local changes in contour.

[1] See p. 409.

Definite longitudinal ridges bound this horizontal area, these extending from each of the tabular "horns" anteriorly to a point 2 cm. on either side of the midline at the muzzle. A comparison of dorsal (Plate 1) and lateral views (Plate 4) enables one to trace the general outline of these ridges. The skull table slopes gently downward posterior to the orbits; anterior to the orbits it slopes more abruptly to the muzzle.

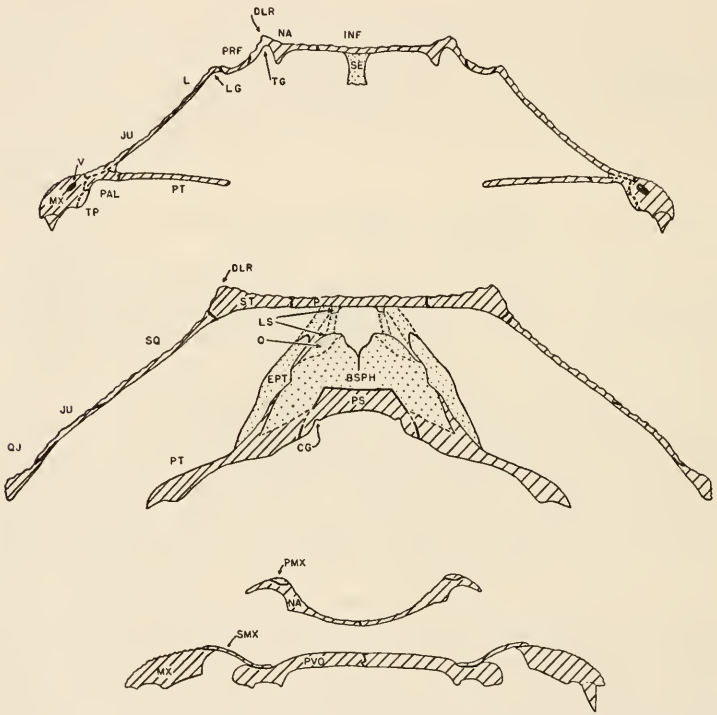

Fig. 3. *Eryops megacephalus.* Transverse sections of skull. Position of sections shown in Text fig. 1 (p. 409) at levels A, B, C. x 3/10.

The surface enclosed by these ridges is concave as seen in transverse sections of the orbital and narial regions (Text figure 3); a transverse ridge connects the longitudinal ridges midway between the orbits and nares (Plate 4) and a definite ridge crosses the concave area between the anterior rims of the orbits. Less perceptible ridges radiate from the parietal foramen, the most prominent forming an

"X" which centers on the foramen and extends to the dorsal rims of the orbits anteriorly and the lateral surfaces of the supratemporal bones posteriorly. A low but sharply defined crest borders the postparietals posteriorly and continues with diminished height along the tabulars. The bones of this dorsal region are in general thicker posteriorly at the skull table and along the course of the ridges. They are quite thin anteriorly, the central portions of the nasals and the front tip of the internasofrontal being especially fragile.

The lateral portions of the skull roof slope downward on either side from this horizontal region. From the anterior end of the jugal back to the otic notch the angle of slope is about 50° (Text fig. 3, b and c). Anteriorly the lateral wall slopes more gently as it approaches the muzzle; posteriorly it curves mesially to meet the palatoquadrate complex.

The bones of the lateral portion of the skull are involved in the formation of the narial and orbital openings and in addition bear structural ridges anteriorly. The most prominent ridge (Plate 4) extends from a point on the prefrontal element immediately in front of the orbit forward and outward to a point about 4 cm. in back of the narial opening. An elevation leads from the anterior portion of this ridge to the margin of the skull over the widest portion of the maxillary. A depression occurs in the lateral wall between the dorsal longitudinal ridge and the ridge described above, and a prominent depressed region is also present anteroventral to the orbits. The bone is quite thin in these depressed regions but is thicker posteriorly and at the margins.

Rough pitted sculpture occurs over the dorsal surface of the skull. These pits are quite small about the margin and are larger posteriorly than anteriorly, the largest being situated in the jugal region. The sculpture is, in some cases, oriented in relation to the ossification centers of the elements (Plates 1, 4, 5, 6) much as has been noted in a number of other fossil forms by Bystrow ('35).

A ventral view of the skull (Plate 2) shows the dentition, palatal openings, and the general structure of the palate. Marginal teeth are present on the premaxilla and maxilla and, in addition to these, pairs of teeth are borne in "craters" on the prevomers, palatines, and ectopterygoids. Tiny denticles, not apparent in the figures, are to be found over much of the palatal surface except on the parasphenoid. In some small specimens, doubtfully referable to the species *megacephalus* such denticles appear even on this element and are especially numerous on that surface of the bone between the basipterygoid processes.

Three pairs of openings are seen in the palate. Anteriorly the internal narial openings are prominent. Posterior and medial to these are situated the medium-sized interpterygoid vacuities. These are bounded laterally by the pterygoids and in front by the prevomers, which widely separate the pterygoids anteriorly. The parasphenoid provides the median boundary between the two vacuities and probably joined the prevomers anteriorly. The posterior ends of the prevomers and the anterior end of the sphenethmoid are fractured in every specimen examined and no evidence exists as to the manner of junction of these elements. Posteriorly and laterally the adductor fenestrae are prominent. These are bounded mesially by the pterygoids, anteriorly by the ectopterygoids, and anterolaterally and laterally by the quadratojugals; the posterior boundary is formed by the quadrate. The fenestra is narrow anteriorly and expands abruptly behind the tip of the descending flange of the pterygoid.

The bones of the palate are more or less horizontally situated anterior to the basipterygoid processes. Thick bone is found anteriorly underlying the surface in front of a line across the posterior rims of the prevomerine tooth craters, and quite thick structural ridges extend from the prevomerine craters anteriorly toward the marginal tooth row and posteriorly along that portion of the prevomer which extends between the palatine and pterygoid. The inner margin of the internal narial opening is also quite stout. A shallow basin of thin bone (2 mm.) is formed by the prevomers behind a ridge connecting the posterior rims of the prevomerine tooth craters. Anteromesially the border of the pterygoid is quite thin; it becomes thicker as it approaches the basipterygoid process. Its descending flange (Plate 4, *PT*) is quite thick. The articular surface of the quadrate is prominent in ventral view. This bone is quite small and is overlapped both laterally and mesially by dermal elements. The parasphenoid is the prominent median element which underlies most of the ventral surface of the braincase, probably reaching the prevomers anteriorly, and forming a stout sutural connection with the pterygoids laterally.

Cartilage bone elements of the braincase visible in ventral view (Plate 2) include the sphenethmoid anteriorly and the otic ossification and the occipital bones posteriorly. The sphenethmoid is the most massive element of the entire skull. Its anterolateral walls are recessed and in continuity with channels leading from the cranial cavity. The otic elements, each of which occupies the region usually taken by pro- and opisthotics, are expanded laterally. These lateral expansions extend to the skull roof beneath the tabulars posteriorly and the

supratemporals anteriorly. The fenestra ovalis is immediately above the posterodorsal suture of the parasphenoid. The occipital bones are best described in posterior view.

If the superficial bones of the palate be removed (Plate 3) certain hitherto undescribed features of the under side of the skull roof become visible. These include the obverse of the ridges noted on the dorsal surface of the skull and also bony emplacements for the cartilaginous nasal capsules. The counterparts of the preorbital portions of the dorsal longitudinal ridges appear as deep grooves leading forward from the region anterior to the orbits to terminate anteriorly and mesially at pronounced depressions which are situated behind the septomaxillae. These grooves (Plate 3, *TG*) were probably occupied by trabecular cartilages in life. The oval depressions anterolateral to these grooves (*NAC*), doubtless housed the dorsal portions of the cartilaginous nasal capsules. Each depression is bordered mesially and posteriorly by a sharp rim. Posterolaterally the region presumably occupied by the nasal capsule extended above the anterior portion of the palatine tooth crater, being limited dorsally and laterally by the maxillary. The ventral portion of the capsule probably rested on the dorsolateral surface of the prevomer and the anterodorsal surface of the palatine.

The counterpart of the ridge described above as extending from the prefrontal to a point in back of the narial rim appears as a groove (Plate 3, *LG*). This courses anterolaterally to the posterior wall of the capsular emplacement. The lacrimal duct probably occupied this groove, since no channel can be found for it through the lacrimal bone.

A definite groove (Plate 3, *AG*) runs from a position immediately posterior to the orbital rim to foramina in the jugal. These foramina probably extend to enter a channel in the maxillary bone. This channel, which is not figured, is enclosed in the maxillary bone above and mesial to the tooth row. Posteriorly it is continuous with a channel in the quadratojugal which leads to the paraquadrate foramen.[1] Anteriorly it continues in the premaxillary bone. Small foramina which open from the maxilla into the postero-lateral portion of the space assigned to the nasal capsule probably communicate with this channel.

A posterior view is shown in Plate 6A. The foramen magnum is continuous ventrally with a space which was probably occupied by the notochord in life. These conjoined openings have the outline of an arrowhead, the base of which was occupied by the notochord.

[1] See description of quadratojugal, page 420.

Dorsally and laterally are the post-temporal fenestrae, spaces bounded by the tabulars and postparietals dorsally, and the exoccipitals mesially. The paroccipital process of the otic ossification and the tabulars limit the fenestra ventrally. The rather wide surfaces of the tripartite occipital condyle are composed largely of the exoccipitals, the basioccipital forming the ventral third of the articular area. The stapes (Plate 6C) is only partly in view, extending outward and upward from the ventral portion of the braincase to a position beneath the tabular bone close to the otic ossification.

The mandible is narrow and high (Plate 5). It is 43 cm. in length, the height is 10 cm. at the coronoid process and the width is 6 cm. at the articular, these being the maximum dimensions. The larger teeth are borne on the dentary bone, only tiny denticles being present on the coronoids. Five apertures are visible in the jaw. The largest of these is the meckelian fossa, which is bordered anteriorly by the coronoid, laterally by the coronoid and surangular, posteriorly by the articular, and mesially by the prearticular. The other openings are on the mesial surface and include a mental foramen situated anteriorly at the suture between the splenial and precoronoid bones, a small mandibular foramen in the postsplenial, an inframeckelian fenestra between the angular and prearticular, and a small dental foramen located posteriorly in the prearticular. The sculpturing of the lateral surface of the mandible consists of interrupted ridges and pits anteriorly, but resembles that of the skull roof posteriorly.

THE SEPARATE SKULL ELEMENTS

Dermal Bones of the Skull Roof

In the following sections the various bones of the skull will be considered individually. The dermal elements were for the most part briefly but accurately described by Broom ('13); the present account is essentially an amplification of Broom's as regards these bones. These dermal elements may be divided into two groups, consisting of a dorsal horizontal series, for the most part bounded laterally by the dorsal longitudinal ridges, and a paired lateral series which form the sloping lateral walls and the marginal elements.

The lateral series will be first discussed. Ten bones (Text fig. 1, p. 409, Plates 1,4), the premaxillary, maxillary, septomaxillary, lacrimal, jugal, quadratojugal, squamosal, postorbital, prefrontal, and nasal comprise this series on either side. Of these the premaxillae, maxillae, and quadratojugals also form portions of the palate while the postorbitals,

prefrontals, and nasals extend on to the dorsal horizontal portion of the skull.

The premaxillae form the muzzle and meet at a common suture at the midline. Posterolaterally each forms the anterior border of the external narial aperture and joins the maxillary beneath this opening. Posteriorly the premaxillary joins the nasal, sending a sharp short process over that bone mesial to the narial opening. That part of the premaxillary which underlies the narial aperture forms a base for the anterior portion of the septomaxillary. The latter (Plate 4, *SMX*) is a thin bone which in part rests on the premaxillary and maxillary bones at the ventral rim of the naris. It curves upward in back, closely following the posterior half of the narial rim[1] in such a manner as to restrict the flow of air to the anterior half of the naris. This bone extends mesially well into the narial opening, its basal area (Plate 3) articulating with that portion of the prevomer directly above the tooth "crater."

The maxillary is a long bone, forming most of the lateral margin of the skull. Anteriorly it meets the premaxillary, forms the posteroventral border of the naris and is overlain by the septomaxillary. It meets the lacrimal and jugal mesially and diminishes in size posteriorly, tapering off to the margin after gaining contact with the quadratojugal.

The lacrimal extends posteriorly from the naris two-thirds of the distance to the orbit. It bears a definite ridge over most of its length, the under side of which forms a groove for the lacrimal duct. Laterally it is bounded by the maxillary and jugal, the sutural borders being approximately equal in length. Mesially it meets the nasal and posteromesially the prefrontal. Anteriorly it forms the posteroventral rim of the naris. This bone is quite thin posteriorly at its junction with the jugal and prefrontal.

The jugal is the largest bone of the skull roof. It forms the ventral rim of the orbit, joins the prefrontal anterodorsally and the lacrimal anteriorly. Ventrally it meets the maxillary in a long suture; it tapers to a point anteriorly between that bone and the lacrimal. Posteroventrally it joins the quadratojugal and posteriorly the squamosal. Posterodorsally it meets the postorbital at an irregular suture. The jugal is quite thin in the preorbital region but becomes thicker ventrally and posteriorly, where it is deeply sculptured.

The quadratojugal forms the posterolateral margin of the skull. Dorsally it meets the squamosal and the jugal, the sutures being ir-

[1] In other specimens, e.g., A.M.N.H. no. 4189, the septomaxillary actually meets the posterior rim of the naris.

regular. Anteriorly it is separated from the margin by the maxillary. Posteriorly it is quite stout and strongly overlaps the ventrolateral surface of the quadrate. Immediately anterior to this junction with the quadrate the margin expands laterally and becomes somewhat arched (Plate 4). A foramen, paraquadratum proprium,[1] 0.6 mm. in diameter enters the inner surface of the quadratojugal just above the stout portion which abuts against the quadrate. It communicates with marginal channels of the skull as described above.

The squamosal is a complex bone. It meets the postorbital, the supratemporal, and, to a slight extent, the tabular dorsally. Anteriorly it joins the jugal and ventrally the quadratojugal. Posteroventrally it strongly overlaps the quadrate. The posterodorsal portion of the squamosal turns mesially at more than a right angle, and after an interval of about two centimeters devoid of sculpture, meets the pterygoid. This unsculptured area of the bone faces posteriorly, and above curves posterodorsally to form a considerable portion of the otic notch.

Internally (Plate 3) the squamosal sends a descending process lateral to the quadrate flange of the pterygoid. Ventrally this descending process diverges noticeably from the quadrate ramus of the pterygoid, the space between these probably being filled by cartilage.

The postorbital is small, forms the posterior rim of the orbit and is equally divided between the lateral wall and the skull table. The postfrontal bounds it mesially, the supratemporal posteromesially and the jugal ventrally, by an irregular suture. It is limited posteroventrally by the squamosal.

The prefrontal forms the thick anterior rim of the orbit and extends anteriorly to a point midway between the orbit and naris, the anteroventral portion of the bone being quite thin. It lies between the nasal and lacrimal anteriorly, meets the frontal dorsally, and the postfrontal above the orbit by a short suture. It joins the jugal ventrally. The dorsal longitudinal ridge is prominent on this bone, dividing the surface unequally into a small horizontal area which is on a plane with the skull table, and a much larger area which slopes down with the lateral wall. The contour of this lateral area is interrupted by the posterior portion of the ridge which overlies the lacrimal groove and joins the dorsal longitudinal ridge on the prefrontal just in front of the orbit.

The nasal is large; of the elements of the skull roof it is exceeded in area only by the jugal. This bone extends almost three quarters of

[1] Term employed by Bystrow ('39) in descriptions of *Dwinosaurus* and *Benthosuchus*.

the distance between the naris and orbit, the most anterior portion meeting the premaxillary slightly in front of a line across the anterior borders of the nares. Anterolaterally it forms the dorsal border of the naris, closely approaching or meeting the septomaxillary. It meets its fellow at the midline for a distance of more than half its length, this junction being interrupted posteriorly by the internasofrontal. In back, the nasal tapers between the prefrontal and frontal. Laterally it joins the lacrimal. The dorsal longitudinal ridge divides this bone into dorsal and lateral portions, the dorsal area consisting of two-thirds of the surface of the bone.

The remaining area of the skull roof includes the dorsal and generally horizontal portion between the dorsal longitudinal ridges. This may be divided into a group of six paired bones and a median element. Of the paired bones, the frontals, parietals, and postparietals form a series which meets in the midline while the postfrontals, supratemporals and tabulars constitute a series posterolateral to these.

The median internasofrontal[1] is situated between the nasals anteriorly and the frontals posteriorly. It is 7.5 cm. long and oval in shape. The central and posterior portion of the bone overlies the anterior portion of the sphenethmoid region of the braincase.

The frontal is larger than the internasofrontal. It meets its fellow over the course of half its length posteriorly at the midline and extends anteriorly around the posterior half of the internasofrontal to terminate between that bone and the nasal. It meets the prefrontal laterally, the postfrontal posterolaterally and the parietal posteriorly. The frontals are convex between the orbits and bear a noticeable transverse ridge which follows the contour of this convexity, this ridge being situated on a line across the anterior rims of the orbits. These bones overlie most of the more massive portion of the sphenethmoid region of the braincase.

The parietal is much smaller than the frontal. It joins its fellow at the midline over its entire length, a parietal foramen opening posterocentrally between the two. This bone meets the frontal anteriorly, the postfrontal anterolaterally, the supratemporal posterolaterally, and the postparietal posteriorly. The parietals form a portion of the roof of the braincase and overlie the anterior portions of the otic elements posteriorly and the posterior portions of the spehenthmoid and laterosphenoid regions anteriorly.

The postparietals (or dermal supraoccipitals) form most of the posterior rim of the skull table. These bones are ridged on their

[1] This term as noted by Broili ('16) has priority over the term *interfrontal*.

posterodorsal margins and turn down onto the occipital surface. On the occiput (Plate 6A) each bone forms the mesial half of the dorsal border of the post-temporal fenestra and just mesial to the fenestra sends a short process over the exoccipital. A noticeable indentation occurs in the bone mesial to this process and at the midline it meets its fellow in a second ventral extension which reaches the dorsal border of the foramen magnum. The postparietals join at the midline, extend to the parietals anteriorly, the supratemporals anterolaterally, and the tabulars posterolaterally.

The supratemporal is thick, roughly hexagonal in shape and overlies the otic and in part the supraoccipital region of the exoccipitals. It joins the postfrontal and postorbital anteriorly, the parietal mesially, the squamosal laterally, the tabular posteriorly, and the postparietal posteromesially. This bone is elevated laterally, forming a portion of the dorsal longitudinal ridge. Another ridge which is smaller courses centrally from this toward the parietal foramen.

The tabular occupies the posterior corner of the skull table and is prominent in occipital view (Plate 6A) where it forms the lateral border of the post-temporal fossa, joining the postparietal above the fossa and the otic element below. In dorsal view (Text fig. 1,[1] Plate 1) it is seen as an element which meets the postparietal mesially, the supratemporal anteriorly, and to a slight degree the squamosal anterolaterally. It extends freely posterolaterally to form a "horn" which is deeply sculptured and somewhat compressed laterally. The anteroventral portion of this bone bears a definite surface which presumably forms an abutment for the dorsal process of the stapes (Plate 3, *STPD*). An unossified gap exists between this region of the tabular and the dorsal border of the otic in M. C. Z. 1129. In larger and better ossified skulls this region is completely ossified and the sutural relations are not clear.

Dermal Bones of the Palate

(Plate 2)

The premaxillary carries the anterior portion of the marginal tooth row and has in addition a noticeable palatal exposure which extends posteriorly from the tooth row to the prevomers. A definite elevated area with a rough surface occurs at the common suture of the premaxillae behind the tooth row; the function of this rugose area is unknown. This bone is ridged laterally in front of the prevomerine tooth crater. Posterolaterally the premaxillary meets the maxillary just behind the anterior border of the internal naris. Each bone accom-

[1] See page 409.

modates thirteen teeth, very nearly half this number being present and functional. These teeth, ovoid at the base and conical in shape, alternate quite regularly with unoccupied pits. Their distribution and relative sizes are shown in Plates 2 and 4.

The maxillary extends from the premaxillary diminishing in size in back. Anteriorly the maxillary forms the lateral border of the internal naris and mesially it meets the palatine, ectopterygoid, and a small anterior extension of the quadratojugal. Three small foramina are present in this bone along the suture with the palatine behind the posterior rim of the internal naris. These foramina (not shown in the figures) evidently communicate with the channel in the maxillary bone described in the general section above. Accommodations for 36 teeth appear on the left maxillary and 38 on the right. Two-thirds of the possible number of teeth are visible on each bone, these occurring in three or four groups interrupted by a series of alternating teeth and pits. It is probable that teeth were replaced in "waves" along the maxillae rather than by simple alternation as in the case of the premaxillae. As will be noted below, the dentition of the dentary correlates well with this mode of succession, the teeth underlying the premaxillary alternating regularly in the dentary, while the teeth underlying the maxillary correspond closely to those of that bone in their distribution.

Two groups of larger teeth are present in the upper jaw; counting both teeth and pits from the midline, it is seen that tooth number 10 on each side marks the center of a group of larger teeth on the premaxillae, while on the maxillae, tooth number 19 or 20 marks the center of another group of large teeth on each side.

The remainder of the palatal elements, except for the parasphenoid, which will be described later with the braincase, may be divided into two series of bones. The first consists of dermal elements and includes the prevomers, palatines, ectopterygoids, and pterygoids. The second series, including the remnants of the primary palatoquadrate arch, the epipterygoids, and the quadrates, will be considered in a separate section. This complex of cartilage and dermal bones is firmly joined to the rest of the skull.

The prevomers constitute most of the central palatal area anterior to the tip of the sphenethmoid. These, with the premaxillae, form a horizontal shelf, which extends back to a line across the posterior rims of the prevomerine tooth craters. This shelf is bounded on either side by a longitudinal elevation which is surmounted by the tooth crater. This elevation extends posterolaterally, following that portion

of the prevomer which is between the palatine and ectopterygoid. The prevomer is quite stout laterally where it forms the rim of the internal naris and is also thick in the region of the "shelf" described above. Posteriorly and centrally the prevomers are thin and form a shallow basin which is convex dorsally. Each bone meets its fellow in the midline over most of its length but separates posteriorly and tapers into a process which leads back toward the parasphenoid. The posterior edge of each process of the prevomers is fractured in M. C. Z. 1129, as is the anteriormost edge of the parasphenoid. The manner of connection of these elements is a matter of conjecture; a possible restoration is shown in dotted lines in Plate 2.

The palatine borders the internal naris posteriorly. It bears the largest tooth crater of the palate near its lateral border just posterior to the internal naris. This bone is solidly articulated with the maxillary beneath the posterior portion of the tooth crater and is quite stout at the rim of the naris. Above and in front the bone is excavated to accommodate a portion of the cartilaginous nasal capsule, as previously described. Laterally the palatine joins the maxillary, mesially the prevomer, and posteriorly it extends in a narrowing process which turns mesially and ends between the ectopterygoid and pterygoid.

The ectopterygoid is a narrow bone posterior to the palatine between the maxillary and quadratojugal laterally and the pterygoid mesially. A large crater occupied by a tooth and pit is situated anteriorly just inside the suture with the maxillary. The bone is thick beneath this crater, and is also stout along its suture with the maxillary and in back where it joins the pterygoid mesially and the quadratojugal laterally to form the anterior border of the adductor fenestra.

The pterygoid is the largest and most complex bone of the palate. For descriptive purposes it may be divided into four regions:

1. A proximal portion consisting of the basipterygoid articulation and that part of the bone dorsal to it which is transversely oriented.[1]

2. A palatal ramus which is generally horizontal and extends anteriorly to meet the dermal palatal elements.

3. A posterior quadrate ramus which is more or less vertically oriented.

4. A descending flange which constitutes the ventralmost portion of the pterygoid.

These arbitrary divisions will be considered in the order given. The basipterygoid articulation of the proximal region is in part composed of a substantial sutural connection of the pterygoid with the

[1] "Lamina postquadrata" of Sushkin ('27).

ventrolateral portion of the parasphenoid.[1] This connection is very firm, as is shown by the interdigitating articular surfaces (Plate 10A) of the parasphenoid. Above this articulation the pterygoid forms a cup (Text fig. 3C, Plate 3) which accommodates the distal end of the basipterygoid process of the basisphenoid. Dorsal to the basipterygoid region and extending laterally, the pterygoid forms a transverse flange, the anterior face of which is mainly occupied by the epipterygoid (Plate 9ab.) This transverse flange extends to the skull roof, which it either approaches closely or meets beneath the supratemporal-squamosal suture (Text fig. 3C). It descends mesially from this point to follow the contour of the expanded portion of the epipterygoid. Laterally it makes an abrupt turn posteriorly and becomes continuous with the quadrate flange.

The horizontal palatal ramus [2] extends forward from the proximal portion to meet the ectopterygoid, palatine, and prevomer. It underlaps the prevomer, tapering to a point over the lateral ridge of that bone. The mesial edge of the palatal ramus is thick proximally, but distally becomes much thinner and is quite thin and fragile anteriorly. The base of the expanded portion of the epipterygoid overlaps the dorsal surface of the proximal portion of this process.

The quadrate ramus extends from the lateral portion of the transverse region to the squamosal and quadrate. This ramus meets the surface of the descending process of the squamosal mesially and overlaps that bone to a considerable extent posteriorly (Plates 1, 3, 9). Below, the pterygoid curves ventrally and laterally to form the mesial border of the adductor fenestra. Posteriorly it overlaps the posteromesial surface of the quadrate.

That region of the pterygoid which projects downward and forms the anteromesial border of the adductor fenestra is the descending flange (Plate 4b, *PT*). This flange is thick, and dorsally provided the surface of origin for an adductor muscle of the jaw.

The Primary Palatoquadrate Arch

(Plates 6, 9)

The ossifications of the primary palatoquadrate arch include the quadrate and epipterygoid. The latter is leaf-shaped ventrally and produces a free dorsal "rod" which extends up to abut against the

[1] The suture between the parasphenoid and pterygoid is clearly defined on both sides in the specimen. Cf., Dempster ('35, pp. 176-177).

[2] A groove on the dorsal surface of the palatal ramus may be related to a cartilaginous palatal process.

parietal immediately lateral to the side wall of the braincase slightly behind a line across the parietal foramen. A large part of the leaf-like expanded region of the epipterygoid is firmly applied to the transverse portion of the pterygoid, but dorsomesially that portion which is beneath the rod is thicker than the rest and articulates with the basisphenoid, fitting into a depression on the anterolateral face of that bone (Plate 10a). Posterolateral to the rod the dorsal margin of the epipterygoid (Plate 9) curves upward on to the dorsal portion of the pterygoid. There it loses its finished surface and closely approaches an unfinished area on the upper portion of the otic ossification. This dorsal region of the leaf-like portion is in continuity with the otic ossification in older specimens, and has been termed the prootic process of the epipterygoid by Sushkin ('27). In the specimen here described, the prootic process was evidently completed in cartilage. The region of the epipterygoid lateral to the prootic process is quite thin and bears unfinished surfaces at its dorsal and lateral margins. It is possible that these surfaces were joined by cartilage which extended to the quadrate—if one assumes that the gap between the descending process of the squamosal and the pterygoid was occupied by cartilage. There is no certain indication of a cartilaginous palatal process,[1] the anteroventral edge of the epipterygoid bearing a smooth sutural relationship with the pterygoid beneath.

The quadrate (Plates 3, 6, 9) is a wedge-shaped bone, the lateral and mesial surfaces of which are covered by overlapping dermal elements. In posterior view (Plate 9) it is only partly exposed and tapers dorsally between the pterygoid and squamosal. A prominent tubercle[2] occurs ventrolaterally on this surface. Dorsolaterally the quadrate is overlapped by the squamosal and ventrolaterally it meets the quadratojugal, which forms a strong abutment against it, enclosing its anteroventral margin. Posteromesially it is very widely overlapped by the pterygoid. This considerable overlap is apparent if the posterior exposure (Plate 6A) of the quadrate be compared to the anterior exposure (Plate 9a). In the latter view the quadrate is seen to extend mesially. The proximal edges of this bone which overlie the pterygoid are unfinished as is the surface of the pterygoid. This rugose surface of the pterygoid extends dorsally, approaching the region of the descending flange of the squamosal. As was mentioned above, the space between the descending flange of the squamosal and the pterygoid was originally occupied by cartilage which may have extended to the lateral

[1] A shallow groove on the dorsal surface of the proximal portion of the palatal process of the pterygoid is probably a structural feature rather than an emplacement for cartilage.
[2] This is identified as the "tuberculum supratrochleare" by Bystrow ('39).

and dorsal surface of the expanded portion of the epipterygoid. If cartilage existed over the rough surfaces of the pterygoid and quadrate, it is possible that the quadrate and epipterygoid were more or less completely connected by cartilage.

The ventral surface of the quadrate forms the articular area for the mandible. Its form is shown in Plate 3. This surface is rugose, probably having been finished in cartilage.

The Mandible

(Plate 5)

Ten bones form the mandible including the dentary, splenial, postsplenial, angular, surangular, prearticular, articular, and a series of three coronoid elements. The dentary is the largest of these, extending back from the symphysis over five-sixths of the length of the jaw. It forms most of the symphysis with the exception of a small ventral region and appears on the mesial surface of the jaw anterior to the mental foramen. Most of the lateral surface of the mandible beneath the tooth row is composed of this bone. It meets the splenial anteroventrally, joins the postsplenial by a long suture ventrally and slopes upward in contact with the angular to taper to a point far back on the surangular. Medially it is bordered by the coronoids.

Accommodations for 47 teeth appear on the dorsal surface of the dentary and an additional pair of small teeth are situated behind the regular tooth row near the symphysis. The teeth alternate with pits in a manner similar to that seen in the upper jaw, those beneath the premaxillary alternating regularly, and the teeth beneath the maxillary appearing in groups which compare closely in distribution with those on that bone above. Not conformable, however, are the groups when compared as to size. They occur as follows in the dentary, if the teeth be numbered from front to back: numbers 1–4 are large; 11–14 are the largest of the jaw, and teeth 25 and 26 represent the center of a third group which is distinctly larger in size than the others in that region of the jaw. When matched with those of the upper jaw it is seen that the larger groups of teeth of the dentary alternate with those above, roughly occurring in front of, between, and behind the two larger tooth groups on the premaxillary and maxillary.

The dorsal surface of the dentary includes a narrow, horizontal, shallow trough inside the tooth row. This is possibly the site of origin of the replacement teeth. Mesially the coronoid series forms the

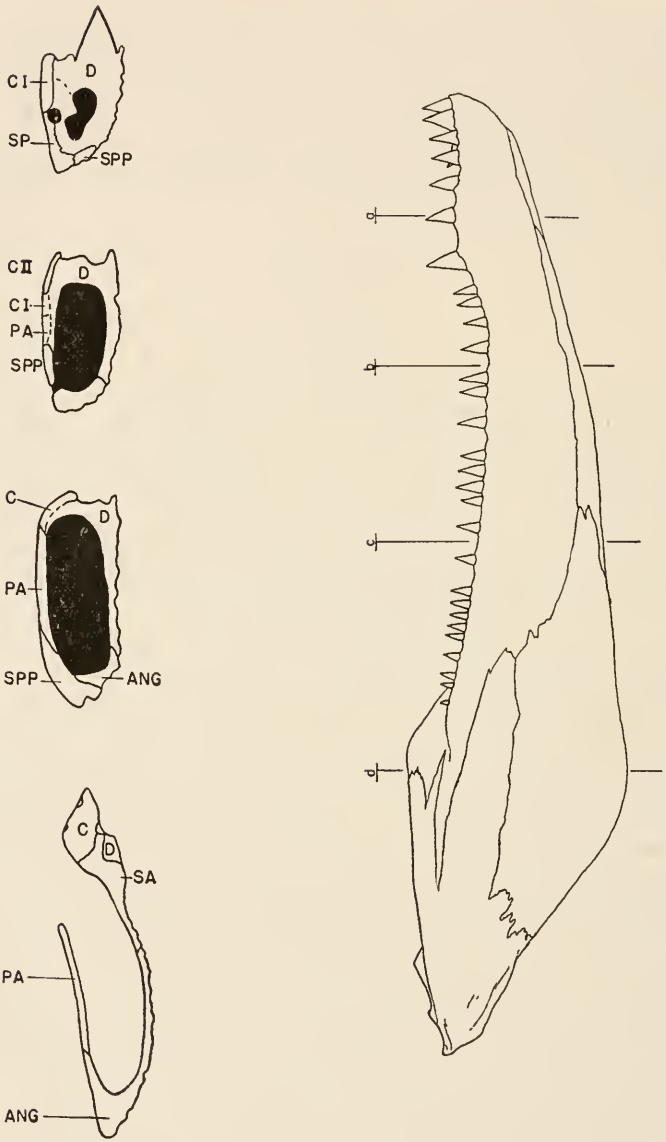

Fig. 4. *Eryops megacephalus*. Sections through mandible. x 1/2. Mandible x 3/20.

boundary to this trough, extending above the border of the dentary to form a rim, as seen in sections (Text fig. 4). This trough becomes narrower and disappears posterior to the tooth row. The rim formed by the coronoids is interrupted at points beneath the large teeth which occur in the tooth craters of the palatine and ectopterygoid bones.

The splenial is situated at the ventral margin of the anterior portion of the jaw. Laterally it is barely visible beneath the dentary; anteromesially it forms a small part of the symphysis and is in contact with the dentary for a short distance at the inner surface of the jaw. It is most largely exposed on the mesial surface of the jaw where it is bounded by the precoronoid dorsally. A small mental foramen is located anteriorly at the junction of the sutures between precoronoid, dentary, and splenial. This is in communication with a mesial diverticulum of the meckelian canal.

Also on the ventral margin of the jaw is the long postsplenial, lying between the dentary on the lateral surface and the prearticular and precoronoid mesially. It is exposed only slightly in lateral view but has a large exposure in medial view. Anteriorly it meets the splenial and posteriorly is in contact with the angular along an irregular suture. A small mandibular foramen in communication with the meckelian canal occurs anteriorly on its mesial surface. This bone forms the floor of the meckelian canal over most of its length.

The angular constitutes the entire posteroventral area of the jaw as seen laterally, but is restricted to the ventral portion of that region of the mesial side. It meets the postsplenial anteriorly and the surangular and to a slight degree the articular posteriorly. Anterodorsally it joins the dentary on the outer side of the jaw and posterodorsally the surangular. On the mesial side it is limited dorsally by the prearticular and forms the ventral rim of the inframeckelian fossa. Internally it floors the posterior part of the meckelian canal and forms the ventrolateral wall of the meckelian fossa.

The surangular is mainly exposed on the lateral surface of the jaw. It joins the coronoid dorsally with an irregular suture, is overlapped below this by a long tapering process of the dentary and extends anteriorly between that bone and the angular. Behind, it overlaps the posterior portion of the articular and forms a strong abutment on the anterolateral surface of that bone, extending over a considerable portion of its surface inside the meckelian fossa. The rim of the surangular, anterior to the articular, bounds the meckelian fossa laterally, and most of the dorsolateral wall of the fossa is made up of this bone. No retroarticular process is to be found on the jaw but small ridges occur

on the posterodorsomesial surface of the surangular, which are possibly scars related to the insertion of the depressor muscle.

The prearticular is the largest bone on the mesial surface of the jaw, extending from the precoronoid to the articular. It is limited anterodorsally by the coronoid series, tapering anteriorly between the precoronoid and postsplenial. Its free thin dorsal surface forms the mesial rim of the meckelian fossa, the bone itself bounding the fossa mesially. Posteriorly it overlaps the mesial surface of the articular. The angular and postsplenial constitute its ventral boundary. A small dental foramen occurs posteriorly in this bone, but cannot be traced to the inside of the jaw. Ventrally, near the anterior end of the angular, this bone forms the dorsal rim of the inframeckelian fossa.

The articular is a small wedge-shaped bone considerably overlapped by the dermal jaw elements and exposed above in an elongately oval articular area, the form of which is shown in Plate 5. In front, this bone forms the posterior wall of the meckelian fossa, and extends downward between the surangular and prearticular probably to rest anteriorly on the angular. This anterior process of the bone bears an unfinished surface distally; this was evidently continued in cartilage which probably extended anteriorly into the meckelian canal as a remnant of the meckelian cartilage. On the mesial surface of the jaw it is slightly exposed between the prearticular and surangular and barely meets an attenuated process of the angular below (Plate 5, fig. *E*).

The three coronoids form the dorsal portion of the inner surface of the mandible. The distal two of these are quite thin, and are applied largely to the dentary which bone entirely underlies the pre-and intercoronoid as well as the anterior portion of the coronoid. The last is the posteriormost and largest of the series. It produces a flange which provides a part of the surface for insertion of the adductor muscles. The coronoid meets the dentary laterally and forms an interdigitating connection with the surangular posteriorly. It bounds the anterior portion of the meckelian fossa and extends anteriorly, sloping mesially to the inner surface of the jaw. Anteriorly, it meets the intercoronoid and ventrally it is bounded by the prearticular. Small denticles occur on its anteromesial surface.

The pre- and intercoronoids are vertically placed, the latter being the smallest bone of the jaw. It lies above the prearticular and the posterior third of the precoronoid and meets the coronoid behind. The precoronoid extends from a point on the dentary behind the symphysis to the prearticular posteriorly, tapering between that bone and the intercoronoid and meeting the splenial and postsplenial ventrally. A

fragment is missing at its posterior boundary in the specimen which is figured. Denticles were missing on the two anterior coronoids in this specimen, but it is probable that these were removed in the course of preparation. In other specimens they are present on the exposed surfaces of these bones.

The general shape and extent of the meckelian canal is shown by means of sections in Text fig. 4. Two channels are present in the anterior end of the jaw, one of irregular shape leading toward the symphysis and ending blindly, the other leading mesially to the mental foramen.

The Braincase

For the most part the neural cranium of *Eryops* is formed of endochondral bones which are neither completely nor clearly distinguished by sutures. These elements may conveniently be divided into anterior and posterior groups. The anterior division includes a massive sphenethmoid region in front, a basisphenoid region posteriorly, and a laterosphenoid region laterally. The posterior division includes a single otic ossification, here termed the otic, a basioccipital and the exoccipitals.

In sagittal view (Plate 10b) it is apparent that the internal portion of the braincase is unossified centrally between the basisphenoid region and the basioccipital, and laterally there is a large gap between the otic ossification and basisphenoid ventrally; the principal junction of the latter elements occurs laterally (Plate 10a). The unossified regions were evidently completed in cartilage, but suggest a fundamental point of division of the braincase into anterior and posterior portions as noted above. There is also a small unossified gap in front of the sella turcica (*SET*, Plates 10b, 7B) which incompletely separates the basisphenoid from the sphenethmoid. Otherwise the sphenethmoid, basisphenoid, and laterosphenoid regions are essentially a unit with only indefinite indications of other lines of demarcation existing between them.

The posterior portion of the braincase is externally divisible into occipital and otic ossifications. The otic ossification, which occupies the regions usually formed by pro- and opisthotics in tetrapods, is externally limited from the basisphenoid region in front and the occipital region behind by sutures (Plates 6B, 9a). The basioccipital is also a distinct element, but the exoccipitals are unusual in meeting at the midline above the foramen magnum where they apparently occupy the position usually taken by the supraoccipital. No sutures can be seen between these bones within the braincase.

A third and minor division of the braincase consists of dermal bones. Ventrally the parasphenoid enters into such intimate relationships with the endochondral bones above that it is best described with the braincase. Dorsally the parietals form a considerable portion of the cranial roof.

The stapes, although not properly a braincase element is also considered in this section.

1. *Anterior Division.* The sphenethmoid region (*SE*, Plates 2, 3, 7AB, 8, 10) of the anterior division is arbitrarily defined as the massive anterior portion of the braincase which ventrally (Plate 10b) extends back to an unossified region in front of the sella turcica, and dorsolaterally it may be considered to terminate in thin lateral walls at the region immediately behind the foramen for the optic nerve (*N II*, Plates 10a, 7B). It is to be noted that no suture is visible between the sphenethmoid and the posterior regions in lateral view, only the deficiency in the floor of the braincase serving as a possible indication of a boundary between the sphenethmoid and basisphenoid. The sphenethmoid, as a region rather than a distinct element, underlies a large portion of the internasofrontal and frontal bones and overlies the anterior portion of the parasphenoid. It flares out laterally in front of the orbits (Plate 3) then tapers anteriorly to end in an unfinished surface. An elongate anterolateral recess is present on either side of this tapering portion (Plate 10a). This recess is in communication with channels leading internally through the bone into the cranial cavity. Internally (Plate 10b) the posterior portion of the sphenethmoid houses the cerebral region of the brain and anterior to this, three paired canals lead to the elongate recess mentioned above. The relations of these are seen to best advantage in a horizontal section of the braincase (Plates 7B, 8b). The ventralmost pair of canals is smallest and probably conducted the vomeronasal nerve, as suggested by Dempster ('35). Dorsal and lateral to this pair another and larger pair diverge. These probably carried the olfactory nerve. The dorsal and lateralmost pair of canals, which possibly conducted blood vessels, slant down anteriorly to join the olfactory canals as shown in the figures. The general shape of the cerebral cavity and the relations of the canals as seen in the sectioned specimen are shown in Text figure 5, *G–N*. The opening for the optic nerve leads from the floor of the cranial cavity in front of the unossified portion of the braincase between the sphenethmoid and basisphenoid regions (*N II*, Plate 10b).

In all of the unsectioned specimens the dorsal wall of the sphenethmoid was observed to end about 1 cm. anterior to the pineal foramen

(Plate 10b). M. C. Z. No. 1458 as reconstructed shows a posterodorsal extension, possibly of the sphenethmoid, which forms a chamber iso-

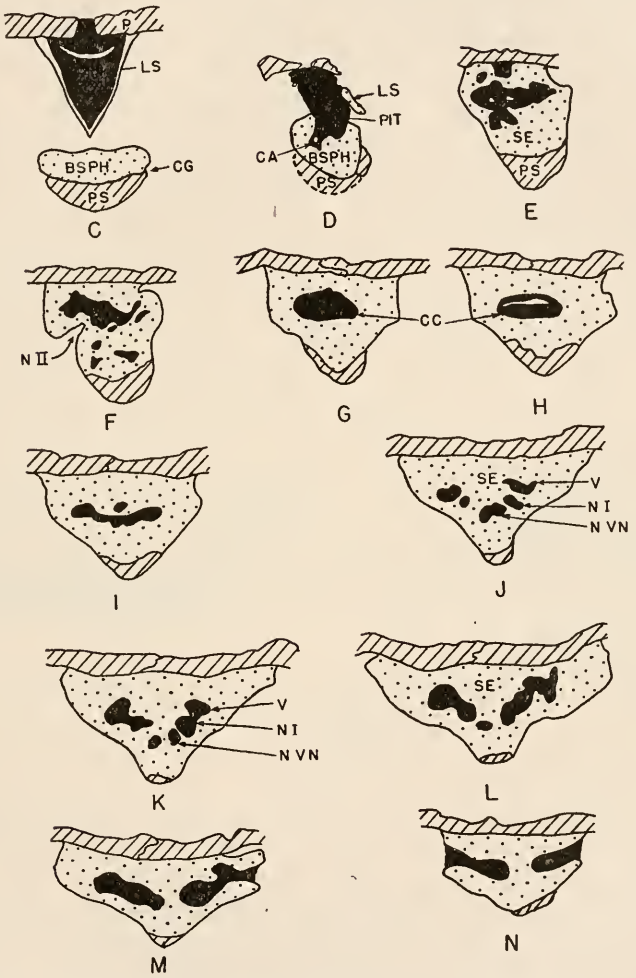

Fig. 5. *Eryops megacephalus.* Transverse sections through anterior portion of braincase. See Fig. 4 for position of sections. x 1/2.

lating the region beneath the parietal eye (Text fig. 2).[1] It is probable, however, that this represents a portion of the lateral wall which be-

[1] See page 413.

came displaced, and hence this is omitted in the rest of the figures (cf. Dempster, '35, pp. 182–183).

Thin lateral walls extend posteriorly from the sphenethmoid region, in back of the foramen for the optic nerve, to the otic ossification and the basisphenoid region. A large part of these walls is missing in the specimens examined and has been restored as indicated by dotted lines in Plates 10 and 7. Its sutural relations with both the otic ossification and the basisphenoid regions are not at all certain and hence have been indicated in dotted lines in the figures. Above, (Plate 8b) the lateral walls may be traced from the sphenethmoid to the otics and are firmly joined to the parietals dorsally. Since this thin lateral region is situated in part in the morphological position of the laterosphenoid of archosaurs it is designated as the laterosphenoid region. Its ventral relationships are uncertain. Posteriorly it apparently joined the dorsum sellae of the basisphenoid, and anterior to this the lateral walls of the anterior portion of the sella turcica (Plates 7 and 9a). At best it can be indicated as a region which is very doubtfully separable from the basisphenoid and is certainly continuous with the sphenethmoid. The restoration of foramina for nerves III and IV is purely arbitrary, but nerve VI has been observed in one specimen leading into a small channel close to the junction of the thin laterosphenoid region with the basisphenoid about 0.8 cm. from the midline (Plate 9a). It is a matter of opinion as to whether the abducens nerve penetrates the dorsum sellae of the basisphenoid region or the laterosphenoid region.

The basisphenoid region is in part distinct internally from the rest of the braincase (Plate 10b), being bounded anteriorly in front of the sella turcica by an unossified area and posteriorly by a gap between it and the basioccipital. Anterolaterally there is a suture between the otic and the basisphenoid region (Plate 9a), but the relations of this bone with the lateral walls are obscure as noted above. The basisphenoid lies dorsal to the parasphenoid and produces basipterygoid processes laterally which, together with the processes of the parasphenoid, form an articulation with the pterygoid and the epipterygoid. The distal end of the basipterygoid process of the basiphenoid is cartilaginous (Plate 3). Above the process, anterolaterally (Plate 10a), the surface of the basisphenoid is depressed for the articulation of the epipterygoid. This relation is diagrammatically shown in section in Text fig. 4B. Anteriorly, just behind the sphenethmoid, the dorsal surface of the basisphenoid bears a definite sella turcica (*SET*, Plate 7) which is pear-shaped in outline, 0.9 cm. wide at the widest

portion, 1.2 cm. long and 0.35 cm. deep anteriorly, becoming shallower posteriorly. Openings for the internal carotid arteries penetrate the floor of the sella anterolaterally. The anterolateral margins have fractured surfaces which were probably continuous with the laterosphe-

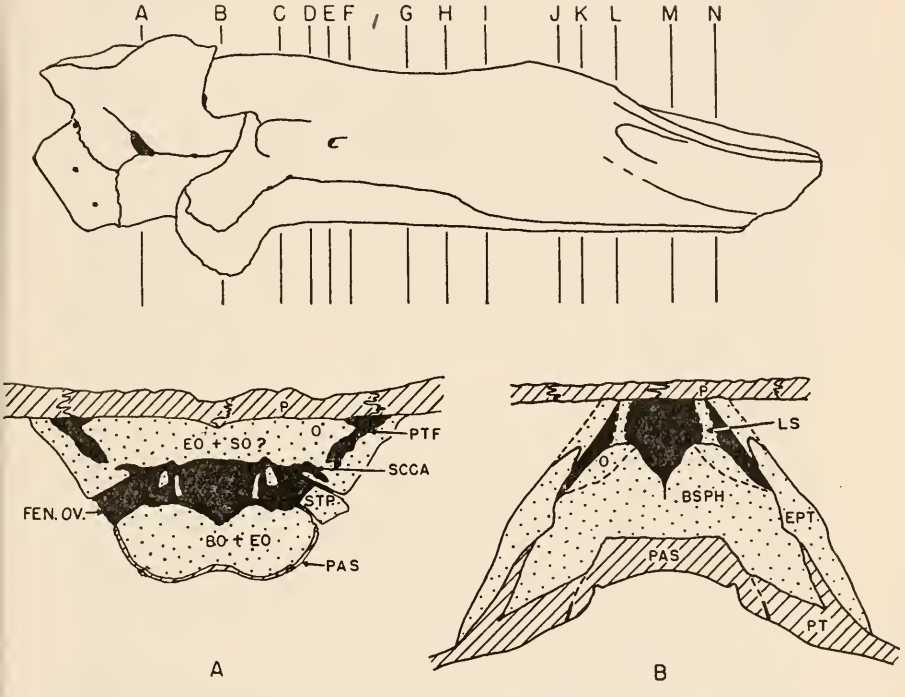

Fig. 6. *Eryops megacephalus.* Transverse sections through braincase. A. Otic region. B. Basipterygoid region. x 1/2.

noid region, but the rim of the posterior portion appears to be finished bone. A thin dorsum sellae, V-shaped in section, extends above and slightly behind the posterior portion of the sella. The dorsum sellae is very fragile and its relations with the lateral walls are not definite. This region is restored in the figures, no clear evidence existing as to its extent laterally.

The thick central surface of the basisphenoid posterior to the sella is V-shaped in section (Text fig. 6). Posteriorly the bone slopes

abruptly to the floor of the braincase immediately in front of the basioccipital. The posterior surfaces of the bone are rough and were evidently continued in cartillage.

Posterolateral to the sella and beneath the dorsum sellae are paired recesses[1] (*REM*, Plates 7, 9a) which probably provided the surfaces of origin for the rectus muscles of the eye. The ventral portion of the dorsum sellae incompletely separates these recesses and leaves an opening for the hypophysial vein ventrally.

Channels for the internal carotid arteries enter foramina in the basisphenoid anterolaterally (*FCA*, Plate 10a). These arteries occupied deep grooves in the parasphenoid which lead toward the foramina on either side (Plate 8a). Within the basisphenoid each carotid leads up to the sella turcica, there presumably sending a branch into the cranial cavity. According to data from the reconstructed specimen, the artery then proceeds under the anterior end of the sella where it again branches, one branch entering the cranial cavity near the foramen for the optic nerve, the other member turning mesially and anastomosing with the corresponding vessel of the other side. Paired nutrient branches appear to lead into the sphenethmoid from this anastomosis.

The above description of the anterior portion of the braincase is in several respects not in agreement with accounts given by previous workers. I agree in part with Dempster's ('35) general analysis of this region of the braincase. He states (p. 177), "The heavily ossified sphenethmoid of *Eryops* is an uncommon feature among amphibians. This bone together with the lateral sphenoids and the basisphenoid, which are fused with it, forms a complete osseous envelope for the midbrain and the more anterior brain parts."

It is evident, however, in the young adult specimen which forms the basis of my descriptions, that the basisphenoid is to be distinguished in part from the sphenethmoid by the ventral unossified region. Otherwise the elements may be distinguished only as regions, and as a more or less united series may be regarded as being comparable with the greater part of the ethmosphenoid of Crossopterygians. The possibility remains, however, that more complete and somewhat younger specimens will reveal sutures in this anter or region. This possibility renders a description by regions desirable until it be definitely proved either that the anterior portion of the braincase is a single ossification or that it represents a fusion of the several elements.

[1] "Myodome" of Dempster ('35).

The fragmentary laterosphenoid region and the usual poor preservation of the anterior part of the basisphenoid has led to highly divergent accounts of this portion of the cranium. Broom ('13, fig. 14) figured the sella in the proper position. Williston ('18) also figured it correctly but his descriptions are somewhat ambiguous. Watson ('16, fig. 1), however, assigned the pituitary gland to the portion of the basisphenoid which appears to be in the position of the recesses for the eye muscles, an interpretation readily understandable because of the frequent loss of the thin floor of the braincase above the recesses. Dempster ('35) placed the gland in an even more posterior position in the unossified region between the basisphenoid and basioccipital. The latter two accounts are not to be reconciled with the evidence gained from the excellently preserved material which it was my good fortune to investigate. The evidence from the sectioned specimens is definite as to the presence of six canals in the sphenethmoid. This differs from the accounts of Broom ('13) and Dempster ('35) who describe four canals but appear to neglect the ventralmost canal here shown in Plate 7B.

2. *Posterior Division.* A single otic ossification on either side houses most of the inner ear structures. This element is not divisible into prootic and opisthotic regions by sutures in either the entire or the sectioned specimens. This is in general agreement with the findings of others. This bone overlies the basisphenoid anteriorly and the exoccipital posteriorly. It is underlapped ventromedially by the parasphenoid. Anteriorly it meets the laterosphenoid region, forming with this the large prootic foramen. Dorsolaterally the otic expands and abuts against the tabular and supratemporal elements.

An anterior view (Plate 9a) shows the prootic foramen (*N V*) and behind and lateral to it a smaller foramen[1] which is the anterior opening of a channel communicating with the posttemporal fossa. The otic bears an unfinished surface above this foramen. This was doubtless completed in cartilage which was in continuity with the prootic process of the epipterygoid as described above. Ventrally there is a suture between the otic and basisphenoid.

In lateral view (Plate 10a) two openings are to be seen. The most evident of these is the large fenestra ovalis which was occupied in life by the footplate of the stapes. The ventral border of the fenestra is formed by edges of the parasphenoid which, in other specimens described by Watson ('16) and Sushkin ('27), is suturally connected to

[1] This foramen was assigned to the facial nerve by Sushkin ('27, fig. 6). This is obviously erroneous.

the base of the stapes. A small foramen occurs about 1 cm. in front of this fenestra on a level with its ventral rim. This is probably an opening for the hyomandibular branch of N. VII. In this view are visible the sutures between the otic and parasphenoid below and between the otic and exoccipital posteriorly. The latter suture extends through the foramen for N. X. These sutures are indistinct or incomplete in most specimens.

Posteriorly (Plate 6B) a suture is visible between the otic and exoccipital. This fades out dorsally in the mesial surface of the posttemporal fossa. Ventrally it extends to the vagal foramen and becomes continuous with the suture described in lateral view.

Posterodorsally (Plate 7A) the otic forms the ventral and lateral surfaces of the posttemporal fossa. More anteriorly it completely surrounds the channel leading from this fossa to the foramen on the anterior surface of the otic (*V*, Plate 9a). A thin plate of bone which is presumably a lateral extension of the exoccipital overlies the fossa and joins the dorsal margin of the otic. No suture is to be seen between these bones dorsally. The postero-dorso-lateral surface of the otic is rough, indicating the presence of cartilage between that region of the otic and the overlying tabular.

Internally (Plates 7, 8, 10) no sutures are visible to distinguish the otic from the occipital. A large aperture beneath and posterior to the ventral margin of the prootic foramen leads from the endocranial cavity to the vestibular region of the inner ear (Plate 7B). In horizontal section the prootic foramen (*N V*, Plates 7B, 8b), is seen as a rather extensive channel, the proximal portion of which extends well into the braincase. This foramen is directed outward at a 45° angle to the longitudinal axis. Ventrally the thin walls of this channel overlie an unossified space which is anterior to the vestibular recess and in communication with it. Dorsally the wall of this foramen,—the parietals above, and the laterosphenoid region laterally,—bound a small cranial recess (*R*, Plates 8b, 10b) which was possibly occupied by a portion of the cranial endolymphatic system.[1] This recess leads ventrally to a groove which is posterodorsal to the prootic foramen and slopes ventrally to the opening between the braincase and the inner ear region. The walls of the otic which overlie the basisphenoid are thin (4 mm.). Apparently no portion of the otic forms a floor to the braincase, the parasphenoid being exposed ventrally.

[1] Watson ('16) and Dempster ('35) find a foramen for the endolymphatic duct in the cranial wall. This may well exist in better ossified specimens in which the cranial wall is more complete. There is no confirmation in the material available to me for the endocranial sutures described by Watson ('16). (Cf. Williston, '18; Dempster, '35.)

The vestibular apparatus[1] of the inner ear was housed ventrally in the otic in the space designated as the otic recess (*ROT*, Plate 7B) but the rough surface of the bone in this region defines no specific structural areas, that portion of the inner ear evidently having been completely housed in cartilage. This space is continuous ventrally with the large cavity beneath the rim of the prootic foramen described above. The larger portion of this anterior space, with the exception of channels for the facial nerve, was probably also occupied by cartilage.

A nerve, probably the hyomandibular branch of *N. VII*, made its exit through the wall of the otic in the most lateral portion of this region (*N. VII*, Plate 10b) and a depression in the otic lateral and ventral to this may indicate the point of departure for the palatine branch of *N. VII* although the foramen cannot be traced through the bone. The relations of this anterior cavity are best shown by the brain cast which will be discussed in a later section.

Dorsally (Plate 8b) the positions occupied by the anterior vertical and posterior vertical semicircular canals are seen as grooves in a cancellous bone with an unfinished surface. There is no definite indication of a horizontal canal; that portion of the labyrinth evidently was lodged either in cartilage or an extremely cancellous bone which was not preserved.

The exoccipitals form the lateral portions of the occipital condyle and extend dorsally on either side of the foramen magnum to join above this opening. There is an external suture between the exoccipital and otic as noted above in the description of the otic. Ventrally and posteriorly (Plates 8a, 6B) there is a clear suture with the basioccipital. The anteroventral surface of this bone is overlapped by the parasphenoid. A dorsal view of the exoccipitals (Plate 7A) shows that these bones meet above the cranial cavity to occupy the region usually formed by the supraoccipital. The sectioned specimen shows no median suture nor any structure which may be interpreted as a separate supraoccipital. Dorsolaterally the exoccipitals join the otics above the posttemporal fenestra as described above.

The external opening of the vagal foramen is on the suture between the otic and exoccipital. The foramen extends through a mass of bone which, as noted below, may be part of the exoccipital. Its internal opening (*N X*, Plate 10b) is above and slightly anterior to two smaller foramina situated in the posteroventral surface of this bone.

[1] The more detailed analysis of the ear region given by Dempster ('35) can not be corroborated by the material available to me. It is possible that his specimens were more highly ossified although this is not indicated by his figures.

These (*N XII*, Plate 10b) lead laterally to openings on the outer surface (*N XII*, Plate 10a) and probably conduct branches of the hypoglossal nerve. The channels connecting these foramina have been carefully checked in the sectioned specimen, and the foramina themselves are constant in all carefully prepared specimens. An inconstant foramen in some specimens appears posterior to the hypoglossal foramina. This cannot be traced in the sectioned specimens and was probably a nutrient opening.

It is likely that the entire dorsal and lateral surface of the braincase posterior to the prootic foramen is a part of the exoccipital. In the sectioned specimens it is impossible to determine where the internal boundary occurs between the otic and exoccipital, and consequently the extent of the participation of the exoccipital in the housing of ear structures is a matter of conjecture.

The basioccipital forms a keystone-like wedge between the ventral portions of the exoccipitals. This bone is exposed posteriorly as the central region of the condyle. Posterodorsally it produces small shelves[1] which overlie the dorsolateral margin of the space presumably occupied by the notochord. Anteriorly the basioccipital forms a portion of the floor of the braincase (Plates 7B, 10b). The entire endocranial surface of this bone, with the exception of the shelf-like portion which overhangs the notochordal space, has an unfinished surface. The central portion is elevated and extends nearly to the posterior portion of the basisphenoid. Posterolaterally the bone meets the exoccipitals. Posteroventrally it is exposed on the lower surface (Plate 8a); unfinished surfaces at the sutural junction of this bone with the parasphenoid and exoccipitals probably formed the base for cartilaginous tubera. Anteroventrally this bone is underlain by the parasphenoid.

3. *Dermal Elements Associated with the Braincase.* The parasphenoid covers most of the ventral surfaces of the braincase. This bone is quite thick in the region of the basipterygoid processes (Plate 10) and becomes thinner anteriorly under the sphenethmoid and posteriorly under the basioccipital, as may be noted in various sections through the braincase (Text figs. 5, 6.) In ventral view (Plate 8a) it is seen to be quite extensive posteriorly, covering the anterior portion of the basioccipital and laterally underlying the anteroventral surface of the exoccipitals and the ventral surfaces of the otics. It underlies the

[1] Watson ('16) described these plates associated with the exoccipitals. Dempster ('35) however, states that the basioccipital forms most of the lower region of the foramen magnum (p. 176), an interpretation confirmed by our material.

basisphenoid almost completely except for the distal ends of the basipterygoid processes.

Pronounced grooves exist on the ventral surface of the bone mesial to the basipterygoid processes. These, as noted by Watson ('16) were occupied by the internal carotid arteries. Each groove extends from the region anteroventral to the fenestra ovalis to a foramen, (CG, Plate 8a), described above, on the suture between the parasphenoid and basisphenoid. Anterior to the basipterygoid processes the parasphenoid rather extensively underlies the posterior third of the sphenethmoid. Anteriorly, it becomes less expanded and thinner, and in the specimen figured, ends in a fractured edge near the unfinished surface at the anterior edge of the sphenethmoid.

In anterior view (Plate 9a) other details of the parasphenoid become visible. It extends dorsally to meet the epipterygoid beneath the articulation of that bone with the basisphenoid and covers the anterior surface of the basipterygoid processes of the basisphenoid to form a strong connection with the pterygoids. The grooves for the internal carotid artery are seen to course upward and slightly inward in this view as they lead to the lateral surface of the basisphenoid. Constant paired foramina occur in this groove on the anterior surfaces of the basipterygoid processes which are with some doubt assigned to the palatine branch of *N. VII.* These cannot be traced in the sectioned specimens.

The extent to which the parietals enter into the formation of the braincase is indicated in Plate 8b, and the position of the parietal foramen is noted in other figures. These bones are removed in Plate 7 to show the deficiency in the braincase bridged by them.

The Stapes: Somewhat more than a half of the right stapes is present in M. C. Z. 1129, and in the reconstructed specimen most of the element is present. The base of the stapes of the prepared specimen is figured (Plate 6C) the dorsal portion being restored from other specimens. It is apparent that the proximal end of the stapes was cartilaginous. No satisfactory details of the mode of insertion of the stapes into the fenestra ovalis may be gained from studies of the specimens. It is obvious, however, that the base as figured was applied only in part to the fenestra and that the ventrolateral portion (*OP*, figs. *A*, *C* Plate 6C) was finished in cartilage which may have been homologous to the operculum of recent forms. The reconstructed specimen, which is better ossified, shows definitely that the parasphenoid was suturally united to the base, an observation made previously by Watson ('16) and Sushkin ('27). The stapedial foramen is close to the base and

extends obliquely upward through the bone from the posterior aspect anteriorly. The stapes extended dorsally and from all available evidence apparently abutted against a depression on the tabular (*STPD*, Plate 3). The portion abutting against the tabular has been termed the dorsal branch by Sushkin ('27) and compared to the dorsal suprastapedial process of reptiles by Goodrich ('30, p. 483). I have carefully examined the specimen which Sushkin figured (Walker Museum 1260) but, compared with other material, this stapes is evidently crushed anteroposteriorly and consequently the lateral branch which he describes may well be an artifact.

4. *Endocranial Cast.* A composite "brain cast" of *Eryops* was described by Dempster ('35) which differs both in contours and interpretation from that described below. The most fundamental differences, as indicated above in the description of the braincase, are concerned with the position of the pituitary gland, the hypoglossal nerve, canals of the sphenethmoid, and the position of the endolymphatic system.

The general shape of the cast is best seen in Plate 12. The inclusion of the unossified area surrounding the parietal foramen and the space assigned to the endolymphatic system prevent an exact delineation of brain regions dorsally. The inclusion in the cast of the notochordal space, the unossified area between the basioccipital and basisphenoid, and the region beneath the ventral rim of the prootic foramen obscure the ventral outline of the brain. Anterior to the cast of the sella turcica (*PIT*, fig. *B*) the unossified space between the sphenethmoid and basisphenoid regions shows as an irregular transverse plate. The region of the inner ear is appended to the brain and shows but little detail ventrally. As suggested in the description of the otic, the vestibular apparatus of the inner ear was probably entirely housed in cartilage. The foramen for the hyomandibular branch of the facial nerve (*N VII*) is indicated in that part of the cast which underlies the prootic foramen. A protuberance ventromesial to this may doubtfully be referred to the proximal end of a foramen for the palatine branch of the facial nerve. The dorsal surface of the otic region shows only the general outlines of the anterior and posterior vertical semicircular canals. The space possibly occupied by the endolymphatic duct is seen as a ridge leading from the dorsal and proximal portions of the semicircular canals to a dorsal prominence above the cast of the prootic foramen (*END*, Figs. *A*, *C*). This may be interpreted as a portion of the cranial endolymphatic system comparable to that of *Ambystoma maculatum* as described by Dempster ('30, Plate 2). De-

tails as observed in the sectioned specimen do not entirely encourage this interpretation, the duct as reconstructed in this apparently leading more directly mesially. Unfortunately the sectioned specimens are somewhat distorted in the otic region.

The approximate locations of the forebrain (*PRO*), midbrain (*MES*) and cerebellum (*CBL*) are bracketed in Plate 12, Figure *A*. The forebrain cast is convex dorsally and ventrally, where housed by the sphenethmoid, and the forebrain probably extended posteriorly somewhat behind the cast of the parietal foramen dorsally and to a point just behind the pituitary gland ventrally. Anteriorly the forebrain region is in continuity with three paired channels enclosed in the anterior portion of the sphenethmoid. The largest of these diverges laterally from the brain and is dorsal and lateral to the rest. It is possible that blood vessels occupied this channel as suggested by Broom ('13). A smaller channel is ventral and mesial to this and probably carried the olfactory nerve. The third and smallest is situated close to the midline and is the ventral most of the group. According to Dempster's ('35) analysis with which I agree, this carried the vomeronasal nerve.

Ventrally the size and shape of the pituitary region is well shown by the cast of the sella (*PIT*, Fig. B). The portion of the arteries leading anteriorly from the pituitary region are also shown in the cast. The form of the diencephalon is not known; the lateral walls of the braincase are restored in the area above and posterior to the pituitary gland.

The midbrain probably extended from the region posterior to the parietal eye to a point marked by the dorsal prominences which have been assigned above to the anterior portion of the endolymphatic system. The cast of the roof of the braincase in this region gives little indication of the shape of the midbrain, which was probably situated well beneath the skull roof. The lateral surfaces of the midbrain region have been restored. Behind the presumed endolymphatic prominences the dorsal surface of the cast slopes downward to the general level of the medullar region. This sloping area was probably occupied by the cerebellum. Anteriolateral to the prominences the cast of the prootic foramen appears as a cylindrical structure diverging from the axis of the brain at a 45° angle.

The ventral contours of the brain are not revealed behind the pituitary gland due to the absence of finished bony surfaces and the extensive gap between the basisphenoid and basioccipital. The ventral surface of the medulla was probably only slightly below the proximal

portions of the roots of the hypoglossal nerve (*N XII*) posteriorly. The abducens nerve (*N VI*) has been indicated in its proper position and coincides in level with the hypoglossal, but no other data can be obtained concerning the ventral contours of the medulla. If cartilage is assumed to be present centrally and the notochord given space posteriorly, the brain would be flat and, in any event could not possess the rather pronounced reptilian sigmoid flexure described by Dempster ('35, p. 193). Otherwise the lack of definite boundaries prevents any judgment as to the amphibian or reptilian characters of the brain.

ANGIOLOGY

The following structures present data for the erection of a portion of the pattern of the cranial arterial system.

1. Pronounced grooves on the ventral surfaces of the basipterygoid processes of the parasphenoid lead to foramina posterolateral to the sella turcica (*CG*, Plate 8a; *FCA*, Plate 10a). These foramina open into channels within the basisphenoid which send branches to the cranial cavity through the floor of the sella turcica and continue anteriorly in the bone to a point beneath the anterior portion of the sella. There the channels again branch, each sending laterally one member to the region of the optic nerve foramen and mesially another which presumably anastomoses with its fellow of the other side. At the anastomosis these last produce nutrient branches which enter the base of the sphenethmoid.

It is obvious that the above structures are concerned with the internal carotid artery which gives rise within the basisphenoid region to cerebral arteries leading through the floor of the sella, opthalmic arteries which pass through the foramen for the optic nerve, and nutrient branches to the sphenethmoid.

2. A groove leading anteriorly from the foramen for the carotid artery (*PAG*, Plate 11) presents evidence for the presence of a palatine artery which branched from the internal carotid before that vessel entered the foramen in the basisphenoid region.

3. A foramen perforating the base of the stapes (*STPF*, Plate 6B, C.) is 2.5 mm. in diameter and was doubtless occupied by a stapedial artery. This vessel probably lead anterodorsally in the cranioquadrate passage between the epipterygoid and lateral wall of the cranium and divided into supraorbital and infraorbital branches as in recent primitive tetrapods. The size of the stapedial foramen indicates the possi-

bility that the mandibular branch was anastomosed by the external carotid artery as in the Crocodilia (cf. Goodrich, '30, fig. 547).

4. The groove on the ventral surface of the postorbital and jugal (*AG*, Plate 3) bones leading to foramina which communicate with a channel in the maxillary bone was probably occupied by a vessel which was a factor of the infraorbital branch of the stapedial artery similar to the *arteria maxillaris* of *Sphenodon*. After entering the maxillary bone this vessel branched, sending vessels anteriorly and posteriorly along the margin of the upper jaw. The posterior vessel may have anastomosed with a posterior branch of the internal carotid artery similar to the *mandibulo-jugalis* (cf., Bystrow, '39, figs. 3, 15) of the Axolotl at the foramen paraquadratum proprium. It is equally possible that an anastomosis was formed with another factor of the stapedial artery or temporal artery as in the frog.

Structures related to the venous system are as follows:

1. *The large prootic foramen* (*N V*, Plate 9a). The principal endocranial vessels probably drained into a large vein, the *vena cerebralis medialis* which made its exit from the cranial cavity by way of the prootic foramen. Outside the cranium, this vessel was probably joined by orbitonasal,[1] ophthalmic and palatine veins, and lead posteriorly as the *vena capita lateralis* (internal jugular).

2. *A foramen in the otic region posterior to the prootic foramen* (*V*, Plate 9a). A vein from the posttemporal fossa possibly emerged from this foramen to join the *vena capita lateralis*. The latter vessel probably led through the cranioquadrate passage between the epipterygoid and cranium and continued posteriorly, dorsolateral to the stapes.[2]

3. *The aperture behind the sella turcica* (*VH*, Plate 10b). A hypophysial vein probably connected the anterior portions of the *venae capitis laterales*. Since the remainder of the cranial foramina are quite small, there is but little possibility of a major drainage occurring through them.

Mandibular and lingual regions were probably served by an external jugular vein. It is evident from the known data concerning the vascular system that the basic pattern in *Eryops* was in general that of a primitive tetrapod. The only feature in which *Eryops* appears to depart markedly from the pattern is indicated by the small size of the stapedial foramen which suggests that here, as in a number of other

[1] The venous channel in the sphenethmoid possibly drained a portion of this region, leaving the braincase somewhere in the restored area of the lateral wall.

[2] Bystrow ('39) assigns the posttemporal fossa to this drainage. To my knowledge there is no evidence in recent forms for this position of the *vena capita lateralis*.

tetrapod groups, the mandibular blood supply may have been derived by secondary anastomoses from the other sources.

MYOLOGY

The various muscles discussed fall into groups which are listed below. The terminology of Edgeworth ('35) is followed:

a. Mandibular muscles.
   Constrictor dorsalis.
   Adductores mandibulae.
   Intermandibularis.
b. Hyoid musculature.
   Depressor mandibulae.
c. Ocular muscles.
d. Narial muscles.

It seems reasonable in the face of evidence brought out in the discussion that the distribution of the jaw muscles in *Eryops* would approach that known in recent reptiles. Unfortunately no muscle scars are present on the skull except for feeble indications on the mandible. The absence of these renders an analysis of the separate jaw muscles largely conjectural as to precise areas of origins and insertions.

Since the skull of *Eryops* is akinetic, it is unlikely that the primary members of the constrictor dorsalis group, which function in moving or bracing the palatal complex, would be functional. If present these were vestigial. It is possible that a derivative of these, the *depressor palpebrae inferioris* (cf. Edgeworth, '35, p. 57; Lakjer, '26, pp. 15 and 25) was retained in *Eryops* in the following position:

Origin. Along the mesial surface of the expanded portion of the epipterygoid, possibly extending anteriorly over the mesial edge of the palatal process of the pterygoid.

Insertion. Lower eyelid and the fleshy part of the palate.

The adductores mandibulae are usually divided into three series of muscles, the *adductores mandibulae externus, medius* and *internus*. In *Eryops* the *adductor mandibulae externus* (cf. Edgeworth, '35, p. 59; Lakjer, '26, p. 31; Adams, '19, pp. 128–129) possibly had the following relations:

Origin. Anterolateral surface of the quadrate, mesial surface of the squamosal and quadratojugal and inner surface of the jugal.

Insertion. Mandible; principally on the coronoid process, possibly extending posteriorly to the dorsomesial surface of the surangular.

The adductor mandibulae externus is separable into three portions in the majority of recent reptiles. These consist of superficialis, medialis and profundus divisions. In *Eryops* space is too limited between the jaw and skull laterally to permit of the function of a superficialis division. The other subdivisions of the externus are indeterminable as separate muscles.

The *adductor mandibulae medius* (cf. Edgeworth, '35, pp. 59–60; Lakjer, '26, p. 53; Adams, '19, p. 129) possibly had the following relations:

Origin. Ventrolateral portion of the epipterygoid, the central and posterior portion of the lateral surface of the quadrate ramus of the pterygoid, and the descending process of the squamosal.

Insertion. Mandible; bones forming the internal surfaces of the meckelian fossa.

It seems improbable that the surfaces of origin of this muscle would extend "far into the parietal region" as described by Adams ('19) since this would interfere with the function of the ocular muscles.

The presence of a *pseudotemporalis* as a division of the *adductor mandibulae medius* is a matter of conjecture. If it were present, it would be represented by that portion of the medius which is given a surface of origin on the ventrolateral portion of the epipterygoid.

The *adductor mandibulae internus* (cf. Edgeworth, '35 p. 60; Lakjer, '26, pp. 58–61; Adams, '19, p. 129) may be restored in *Eryops* as follows:

Origin. Dorsal surface of the descending process of the pterygoid.

Insertion. Dorsal surface of posterior portion of the prearticular. This muscle as described by Adams ('19) is apparently assigned to the ventral surface of the pterygoid for its area of origin. Since denticles are present over much of this surface, this interpretation seems to be improbable.

The *intermandibularis* (cf. Edgeworth, '35, p. 61) probably formed a sheet of muscle between the jaws as in known forms.

The *depressor mandibulae* (cf. Edgeworth, '35, pp. 106–108; Miner, '25) possibly existed as a slip of the *levator hyoidei.* This muscle possibly took origin on the fascia of the mid-dorsal line close behind the occiput and inserted on that part of the surangular which lies posterior to the articular. It was probably weakly developed, the jaw being depressed largely by its own weight.

The rectus group of occular muscles, including the *bursalis* and *retractor oculi*, if present, probably centered in origin near and in the

recess for eye muscles (*REM*, Plate 9a). The *superior* and *inferior obliquii* may have originated on the sphenethmoid dorsally at its lateralmost portion in front of the orbit. There is no definite indication of this region as to the point of origin.

Narial muscles were doubtless present in the nasal region, originating on the septomaxillary bone and inserting on the fleshy rim of the narial opening. These probably functioned in opening and closing the narial aperture.

DISCUSSION

A number of specific morphological problems arising from the study of the skull of *Eryops* have been discussed in the descriptive sections. In the following sections an attempt is made to fit *Eryops* into the general scheme of early tetrapod evolution through a consideration of its general structural features as compared with those found in other early amphibians and reptiles.

Watson ('19, p. 50) noted that the central skull shape among the Labyrinthodonts was represented by that of *Capitosaurus*. He traced this skull form from the Lower Carboniferous embolomere *Anthracosaurus* through various amphibians including *Eryops* to *Cyclotosaurus* of the Upper Triassic and described the general shape of these skulls as follows:

"The characteristic features are the wide muzzle, posterior position and nearness to the middle line of the small orbits, and small otic notches not very widely separated."

It is interesting to note that *Cyclotosaurus* is described as a type illustrating growth regions of the skull by Bystrow ('35). The "zone of intensive growth" in this form lies between the nasal and orbital openings as described by that author, this animal being designated as a member of a group which has but one zone of intensive growth in the skull. Elongation of the skulls in the preorbital region is a primitive tetrapod feature to be correlated with the greater demand placed on the upper and lower jaws as a result of increase in size. This primary elongation was probably initiated early in amphibian history as suggested by Romer ('37, p. 47) who makes the following statement:

"The elongation of the face of early amphibians as contrasted with their piscine relatives is probably related in part to changed food habits and elongation of the jaws, with a necessary elongation of the braincase. In great measure, however, this elongation is probably related to size differences in the forms compared. Crossopterygians

investigated are fishes of modest size; the Embolomeri whose braincases are known are mostly far larger.

"The results of change in size upon proportions of animals are so obvious that they are usually overlooked (but cf. Watson, '30). If, for example, an animal doubles in length, its necessary food intake is (roughly) cubed, and a disproportionate growth of mouth parts tends to result . . ."

This secondary growth of the cranium, as shown by Romer ('37, Fig. 15) affected the braincase of amphibians, resulting in an elongation of the ethmoid region. In relation to this situation, the nasal capsules are widely divorced from the rest of the braincase and presumably were connected with it merely by extensions of the anterior portions of the trabeculae.

Posteriorly, on the skull roof, the pattern of the dermal bones is comparable to that of other non-"anthracosauroid" Labyrinthodonts in that the tabulars are separated from the parietals by the postparietals and supratemporals. The presence of a well developed posttemporal fossa is another general non-"anthracosauroid" feature. Failure of the lacrimals to meet the orbits is a situation widespread in labyrinthodonts. The lacrimal enters the orbits only in the "anthracosauroids" and one or two "loxommids"; in all other forms it is excluded. Primitively the presence of the septomaxilla as a superficial dermal element prevents the lacrimal from reaching the narial rim. In many amphibians, such as the typical stereospondyls, the lacrimal fails to enter the narial margin, even though the septomaxilla is reduced. In spite of the well developed septomaxilla in *Eryops* the lacrimal does, however, form the posterior narial rim.

The palatal region of *Eryops* shows a fixed basipterygoid articulation, medium sized interpterygoid vacuities, a much reduced quadrate, and an epipterygoid with a prootic process. This condition is probably closer to that known in stereospondyls than to that recognized in more primitive Rhachitomi such as *Dendrerpeton* or *Edops*. The former, as described by Steen ('34), is intermediate in a number of characters between embolomerous and rhachitomous forms. *Edops*[1], occurring much later in the Carboniferous, also shows a number of primitive characters. Comparison with these two forms shows that *Eryops* is, in palatal structure, a fairly advanced member of the Rhachitomi.

Dendrerpeton, like *Eryops*, has medium sized interpterygoid vacuities but retains a movable basipterygoid articulation, while in *Edops* the

[1] Data concerned with this form communicated by Professor A. S. Romer of the Museum of Comparative Zoölogy, at Harvard College.

interpterygoid vacuities are much smaller and a movable articulation exists in the basipterygoid region. Certain other features in the primary palatoquadrate arch of *Eryops* are also of phylogenetic interest. Watson ('19) assumed that the prootic process of the epipterygoid was developed in the group Stereospondyli, but the presence of this process, not merely in *Eryops* but also in *Edops* and perhaps in *Dendrerpeton* (cf. Steen, '34, fig. 2F), shows that this was instead a relatively primitive feature. It is possible to interpret the prootic process as a true otic process which ossifies in continuity with the epipterygoid. It falls into the proper position for an otic process in respect to the inferred positions for the vena capita lateralis, the stapedial artery and the hyomandibular nerve, and is, in spite of Sushkin's ('27) objections, probably homologous with the otic process of reptiles. DeBeer ('37) supports this point of view in his analysis of homologues in living forms.

The quadrate is reduced in *Eryops* and the probability that this element and the epipterygoid were joined by cartilage has been shown in the descriptive section.

Soderbergh ('36) has restored the primary palatoquadrate arch in *Aphaneramma, Lyrocephalus* and *Platystega*. This arch, as perhaps in other of the more advanced stereospondyls, appears to have been well developed, with a reduced ossified epipterygoid and a quadrate connected with it by cartilage. In addition, a well developed cartilaginous palatal process was presumably present. It has been noted that there is no evidence of such a highly developed palatal process in *Eryops*. On the basis of the limited existing knowledge of this region it may be assumed that the stereospondyl condition is the retention of an essentially larval type of palatoquadrate. Whether or not the ancestors of the stereospondyls passed through an eryopid stage with a reduced palatal ramus in the adult is uncertain.

A comparison of the braincase of *Eryops* with those of other forms may be facilitated by an attempt to interpret the embryonic condition of the neurocranium. Within limits this also permits a comparison of certain structural features with those of recent amphibia. In most cases it has been possible to compare definite regions of the cranium of *Eryops* with corresponding portions of the chondrocrania of recent forms. Divisions of the braincase are listed below in relation to embryonic structures. The terminology followed, which is concerned with embryonic structures is that of DeBeer ('37).

Basioccipital. This element doubtless ossified in the posterior part of the parachordals.

Exoccipitals. The fact that the exoccipital ossifications appear to include the supraoccipital area has been noted. This implies that the exoccipitals represent an ossification not only of the occipital arches but also of the synotic tectum, a condition not known in amniotes. The presence of two hypoglossal foramina suggest that the number of metotic segments approached or equaled that of reptiles. Dorsally the synotic sectum must have been extensive as is testified by the broad dorsal expansion of the exoccipitals in the supraoccipital region. The foramen for the vagal group of nerves marks the location of the metotic fissure between the occipital arch and the otic capsule.

Otic. The region of the otic capsule was probably largely ossified by the otic although the posterior portion of the capsule may have been invaded by the exoccipital. The capsule was probably joined to the parachordals by means of a basicapsular commissure or commissures, and the presence of a foramen identified with *N. VII* anterolaterally in the otic region suggests the presence of a prefacial commissure which extended from the parachordal cartilage to the otic capsule between the prootic foramen and the foramen for *N. VII.*

Basisphenoid region. The dorsum sellae probably ossified in an acrochordal cartilage while the remainder of the basisphenoid ossified in the region of the posterior portions of the trabeculae. Lateral basitrabecular processes were articulated with the primary palatoquadrate arch, which probably had a palatal process in addition to ascending and otic processes.

Laterosphenoid region. This region probably ossified in the area usually occupied in developing crania by the taenia marginalis dorsally and by the pilae antotica and metoptica. The taenia marginalis probably connected an orbital cartilage with the otic capsule, and the pila antotica extended between the acrochordal cartilage and the taenia marginalis in front of the prootic foramen and behind the oculomotor foramen. The pila metoptica probably joined the trabeculae in front of the pituitary gland, and behind the optic foramen and extended upwards to the taenia marginalis. The area presumably derived from the pila metoptica is difficult of determination due to poor preservation of the lateral wall in the region immediately posterior to the sella turcica.

Sphenethmoid region. This large area probably represents an ossification of the orbital cartilages laterally and a portion of the trabeculae ventrally, the orbital cartilages being joined to the trabeculae by an extensive preoptic root.

Anterior portions of the braincase. The rest of the braincase of *Eryops* remained cartilaginous in the adult form and probably consisted of

cartilaginous extensions of the anterior portions of the trabeculae which connected the dorsolateral part of the sphenethmoid with the nasal capsules as is shown by the architecture of the ventral portion of the skull roof.

The structure as described is generally like that of recent anurans with the exception of the rather narrow interorbital region. This is semi-trophitrabic and is intermediate in nature between the anuran condition and that characteristic of reptiles and the primitive amphibians. The increased number of metotic segments is definitely reptilian as inferred from the XIIth nerve foramina. If the foramen on the anterior surface of the basipterygoid process (*N VII*, Plate 9a) is for the palatine branch of the facial nerve, it may be that *Eryops* developed a frog-like larval pseudobasal process of the palatoquadrate. The true basal process, as DeBeer ('37) has shown, is in front of the palatine branch of the facial nerve. It must be reiterated that the interpretation of the basal articulation made above is a doubtful one. If, however, it is pseudobasal it would be in agreement with evidence indicating the derivation of the Anura from labyrinthodont ancestors (Piveteau, '37; D. M. S. Watson, in press).

If the above analysis of the braincase be compared with that of Romer ('37) for *Megalichthys*, it is seen that *Eryops* differs from this crossopterygian in that the nasal capsule and the anterior portion of the trabeculae, because of facial elongation, are far removed from the primitive position. In *Megalichthys* and all other known crossopterygians the most prominent feature of the braincase is a specialized and kinetic bipartite condition which Romer suggests as "a retention in the adult of an essentially embryonic condition."

It is improbable that *Eryops* conforms to this type of division. There are points of weakness in the adult neurocranium of *Eryops* in the region corresponding to the crossopterygian joint. However, that region in the embolomeres *Paleogyrinus* and *Eogyrinus* is stoutly constructed and it seems likely that in primitive tetrapods this bipartite cranial structure was unknown. There is no doubt that the braincase of *Eryops* is structurally weak between the regions corresponding to the otico-occipital and ethmosphenoid segments of known crossopterygians. In *Eryops* this feature is to be noted in the thin bridge between the laterosphenoid and otic regions, in the gap in ossification between the basisphenoid and basioccipital ventrally, and dorsally in the absence of a roof of endochondral bone between the sphenethmoid and the supraoccipital region.

The definite space for an intra-cranial notochord of *Eryops* is inter-

esting as a point of comparison with the notochordal space in crossopterygians. In older specimens of *Eryops* the notochordal notch as seen in occipital view is considerably overgrown by the exoccipitals or in some cases apparently totally obscured. If the inverse be true, this suggests that in the larval condition the notochordal space would be quite large, although it did not attain the aberrant size seen in crossopterygians.

Very little is known concerning the braincases of Embolomeres except in *Paleogyrinus* and other forms described by Watson ('26). *Eryops* differs from *Palcogyrinus* in the absence of an ossified roof in the middle portion of the braincase (as noted above) and in the wider and less trophitrabic interorbital portion of the basicranial region. Certain differences appear to be present in the lateral cranial wall. Watson describes a very large prootic foramen which appears to contrast markedly with the smaller opening in *Eryops*. However, in *Eryops* the thin bone in this region is often destroyed, making the opening appear much larger, and it is not impossible that a similar condition existed in the single known specimen of *Paleogyrinus*. The foramen above the basal articulation in *Paleogyrinus* is said to be a point of entry for the internal carotids and also the aperture through which the optic and eye muscle nerves left the cranium. In *Eryops* the corresponding region appears to be a foramen for the hypophysial vein and the area of origin for the rectus eye muscles. The anterior massive portion of the sphenethmoid is quite similar in these forms, with the exception that in *Paleogyrinus* it is narrower and has only two channels anteriorly for the olfactory nerve. An obvious difference between these forms is in the occipital condyles, that of *Paleogyrinus* being single and circular.

The braincase of *Palcogyrinus* is a primitive type from which that of *Eryops* could easily be derived.

It has long been recognized, largely on the basis of more superficial structures, that *Eryops* is a generalized rhachitomous form morphologically ancestral to stereospondyls. Watson ('19) has compared *Eryops* with stereospondyls and advanced Rhachitomi, and Case ('33) has summarized the existing evidence, adding new data concerned with *Buettneria*. The braincases of various stereospondyls have been compared with *Eryops* by the above investigators and Soderbergh ('36). Much of the new data given in this study is concerned with the ossified portion of the braincase, and there is obviously nothing that can be added to comparisons with stereospondyls which are notoriously lacking in ossified neurocranial structure.

In most cases only the dermal elements of the skull are known among members of the group Rhachitomi. Most of these data were available to Watson ('19) who made as adequate comparisons as possible considering these limitations. Relatively little significant data has since appeared regarding rhachitomous forms. New information is available, however, concerning a limited number of genera including *Dendrerpeton*, *Edops*, *Trimerorhachis* and *Dwinosaurus*.

Dendrerpeton acadianum, as described by Steen ('34) exhibits many primitive cranial characters. The skull is high, and the palate, as pointed out above, is primitive though definitely rhachitomous. Posteriorly in the braincase the occipital condyle is single and the supraoccipital is unossified. Openings for the vagal group and the XIIth cranial nerves are present and in much the same position as in *Eryops* except that *N. XII* leaves the braincase by a single opening and the foramen for the vagal group is much larger. The basioccipital and exoccipital exist as a single unit separated suturally from the otic capsule.

This animal, as placed by Steen, is intermediate in structure between embolomerous and rhachitomous groups. It is more primitive than *Eryops* in regard to the higher skull and circular condyle. There is conflicting evidence concerned with the state of ossification of the braincase. The otic region is much more complete than in *Eryops*; on the other hand, the supraoccipital is unossified.

Edops appears to differ from *Eryops* in a number of features which in general indicates that it is more primitive than the latter. The braincase is deeper and narrower and the condition of the palate as noted above is generalized. In the relations of the pituitary gland and carotid artery as well as in the general endocranial contour, *Edops* resembles *Eryops*.

New data are available on *Trimerorhachis* through descriptions by Case ('35) and verbal communication by Mr. J. B. Wilson, who is restudying this form. Bystrow ('38) has recently given a full description of *Dwinosaurus*. These two genera are examples of neotenous rhachitomous forms. The considerable time interval which exists between *Trimerorhachis* of the Permo-Carboniferous and *Dwinosaurus* of the upper Permian and the indisputable fact that these were derived from different adult forms, as is shown by the pattern of the dermal elements, does not obscure the parallelisms introduced by neoteny. Both possess well developed branchial arches, and the reduction of the elements of the braincases has reached a similar state in each form. *Trimerorhachis* evidently has advanced less far in the reduction of

neurocranial elements in that the exoccipitals, basioccipitals and a portion of the opisthotics are present. In *Dwinosaurus* only the occipital series is ossified including, however, the supraoccipital. It is of interest that both genera show the presence of double openings in the position of those assigned to *N. XII* in *Eryops*.

Although these neotenous types arose from rhachitomous forms, *Eryops* can not be considered as an ancestor. *Trimerorhachis* retains an intertemporal element which is lost in *Eryops*, and the basipterygoid joint is movable. These features hint of an origin from a more primitive form. In both *Trimerorhachis* and *Dwinosaurus* the lacrimal extends from orbit to naris and in neither case is an internasofrontal element present as in *Eryops*.

Seymouria has been compared with the Rhachitomi by Watson ('19a) who has noted a number of resemblances in the skull. As described and interpreted by White ('39), this form bears closer affinities with the "anthracosauroids" than with other Paleozoic reptiles or amphibians. The skull is more trophitrabic than that of *Eryops* and the condyle is single. The interorbital region of the braincase is decidedly more reptilian in the extreme reduction of the sphenethmoid and laterosphenoid regions. These are represented in *Seymouria* by a slender Y-shaped presphenoid and a paired orbitosphenoid. The pituitary fossa and the dorsum sella are in much the same position relative to paired depressions assigned to the rectus muscles of the eye as in *Eryops*. As would be expected, the cranial foramina are disposed similarly in the two forms except for the exit for *N. XII* which is single in *Seymouria*. The position of the palatine nerve foramen, which has been doubtfully assigned to a position in front of the epipterygoid for *Eryops*, is in back of that process in *Seymouria*. This is the expected relation in a typical tetrapod not having a complication of that region due to the establishment of a pseudobasal process. The path of the internal carotid artery is also modified in that it is largely enclosed in the basisphenoid. The foramen for the vagal group of nerves is quite large, indicating the possibility of a reptilian type of venous drainage of the endocranial region from a posterior cerebral vessel in contrast to the anterior drainage by way of the prootic foramen in *Eryops*. The descending flanges of the pterygoids in *Seymouria* are quite similar, the only exception being in the assumed presence of levators and protractors of the pterygoid in connection with the movable palatoquadrate arch in *Seymouria*, which is another primitive feature of the skull of this reptile. It seems safe to assume that the muscular system of the latter and of *Eryops* approached that of the recent reptiles,

which, according to Brock ('39), is more generalized than that of recent amphibia.

As shown by the characters listed above, the skull of *Seymouria* is much more primitive and reptilian than that of *Eryops*. It is clear that these are divergent forms about equally advanced from a primitive tetrapod condition.

SUMMARY

Modern methods of preparation have permitted a relatively complete description of the osseous cranial structure of *Eryops megacephalus*, a Permo-Carboniferous rhachitomous labyrinthodont. The analysis of the skull yielded data regarding the following morphological features among others:

1. Relation of the cranial nerves to the brain as interpreted from an endocranial cast.
2. Structure of a part of the inner ear and the endolymphatic system.
3. An attempted analysis of the chondrocranium.
4. The possibility of the existence of a larval pseudobasal process.
5. Relations of the anterior portion of the trabeculae and of the nasal capsules.
6. Extent of the cartilaginous palatoquadrate.
7. Existence of an intracranial notochord.
8. Structure of the basipterygoid region.
9. Extent of the lacrimal duct.
10. Presence of a prootic process of the epipterygoid.
11. Structure and position of the sella turcica.
12. Additional metotic segments of the cranium.
13. An analysis of the cranial muscular and vascular systems.

A morphological and systematic study of the skull of *Eryops megacephalus* indicates that this genus occupies a central position among the labyrinthodonts. Evidence presented shows that it may be derived from the primitive morphological stage represented by embolomeres, but that it is well off the line leading to the Reptilia. The structural features seen in *Eryops* may be antecedent to those of the stereospondyls.

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EXPLANATION OF ABBREVIATIONS

A

AG = arterial groove
ANG = angular
ART = articular

B

BO = basioccipital
BPTP = basipterygoid process
BSPH = basisphenoid region

C

CA = carotid artery
CBL = cerebellum
CC = cerebral cavity
CG = groove for carotid artery
CO = coronoid
CO I = intercoronoid
CO II = precoronoid

D

D = dentary
DF = dental foramen
DLR = dorsal longitudinal ridge
DS = dorsum sellae

E

EO = exoccipital
END = endolymphatic organ
EPT = epipterygoid

F

FCA = foramen of internal carotid artery
FD = dental foramen
FEN OV = fenestra ovalis
FR = frontal

I

IMF = inframeckelian fossa
INF = internasofrontal

J

JU = jugal

L

L = lacrimal
LG = lacrimal groove
LS = laterosphenoid region

M

MES = mesencephalon
MF = mandibular foramen
MTF = mental foramen
MX = maxilla

N

NA = nasal
NAC = space for cartilaginous nasal capsule
NCH = notochord
NF = nutrient foramen
N I to N XII = cranial nerves
NVN = vomeronasal nerve

O

O = otic
OA = ophthalmic artery
OP = operculum
OT PR EPT = otic process of the epipterygoid

P

P = parietal
PA = prearticular
PAL = palatine
PAG = groove for palatine artery
PAS = parasphenoid
PC = chamber for parietal eye
PF = parietal foramen
PIT = pituitary gland
PMX = premaxilla
PO = postorbital
POF = postfrontal
POP = postparietal
PRF = prefrontal
PRO = prosencephalon
PS = parasphenoid
PT = pterygoid
PTF = posttemporal fossa
PVO = prevomer = Vomer

Q

Q = quadrate
QJ = quadratojugal

R

R = cranial recess for endolymphatic organ
REM = recess for rectus eye muscles
ROT = otic recess

S

S ANG = surangular
SCC AV = anterior vertical semicircular canal
SCC PV = posterior vertical semicircular canal
SE = sphenethmoid region
SET = sella turcica
SMX = septomaxilla
SP = splenial
SPP = postsplenial
SQ = squamosal
ST = supratemporal
STP = stapes
STPD = abutment for dorsal portion of stapes
STPF = stapedial foramen

T

T = tabular
TG = trabecular groove
TP = ectopterygoid (transpalatine)

V

V = vein
VH = hypophysial vein

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Eryops megacephalus. Dorsal view of skull. M.C.Z. No. 1129. x 3/10.

PLATE **2**

PLATE 2

Eryops megacephalus. Ventral view of skull. x 3/10.

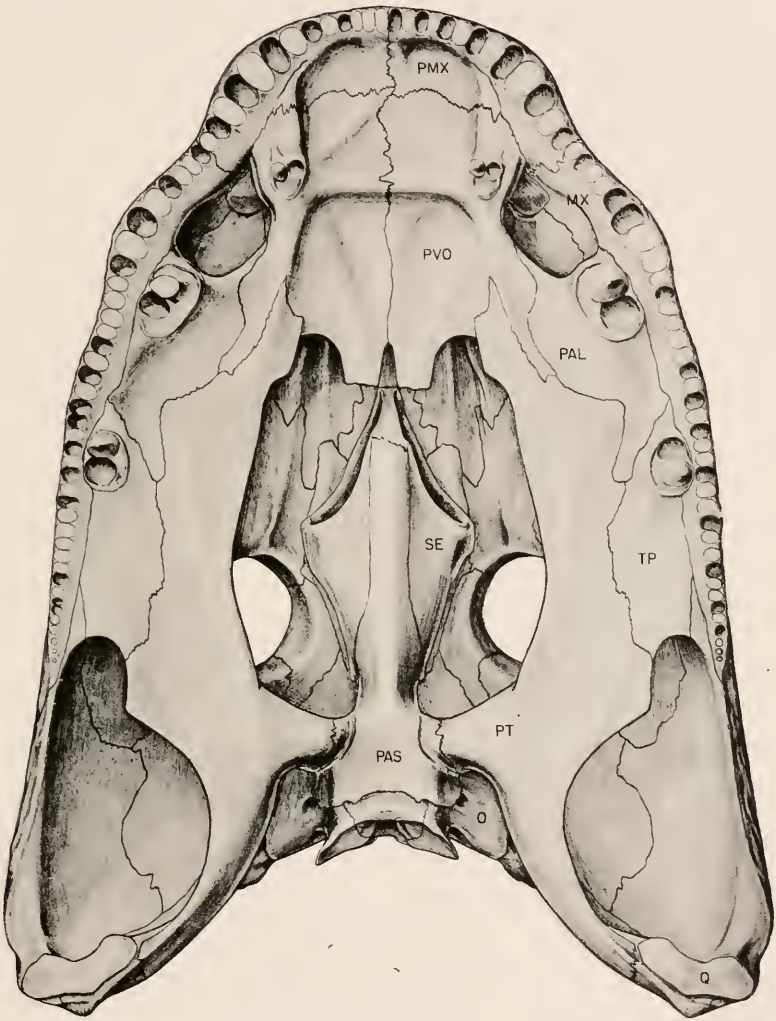
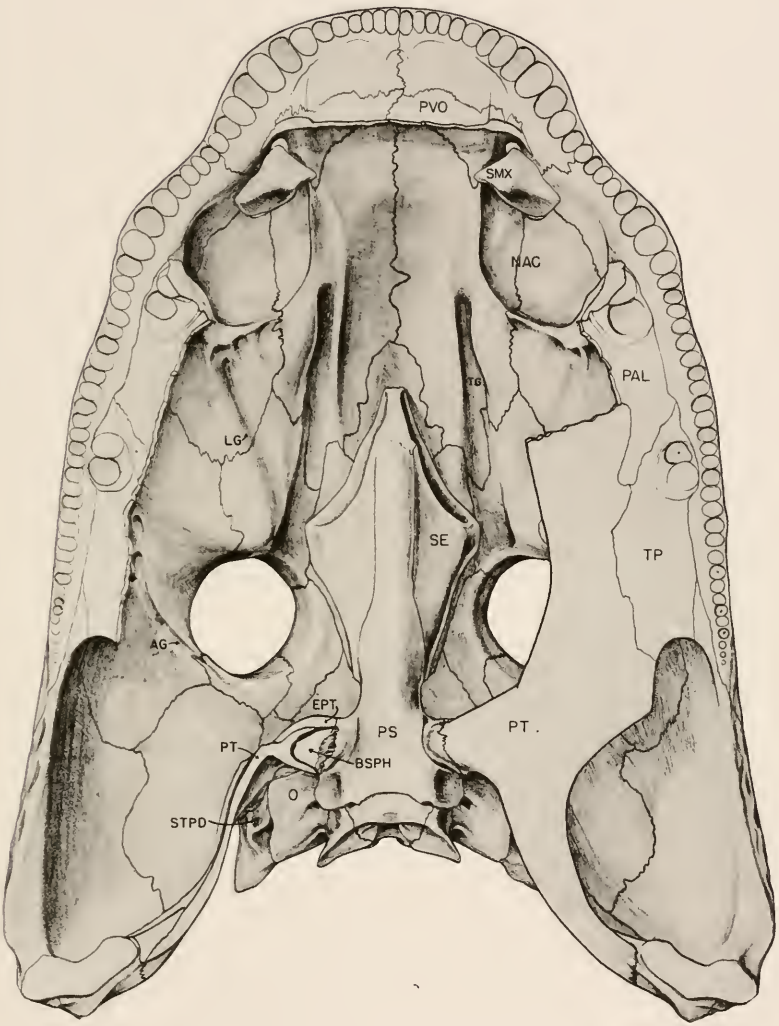

PMX
MX
PVO
PAL
SE
TP
PT
PAS
O
Q

PLATE 3

PLATE 3

Eryops megacephalus. Ventral view of skull with palate largely removed. The right basipterygoid process is shown in horizontal section. x 3/10.


PVO
SMX
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AG
EPT
PS
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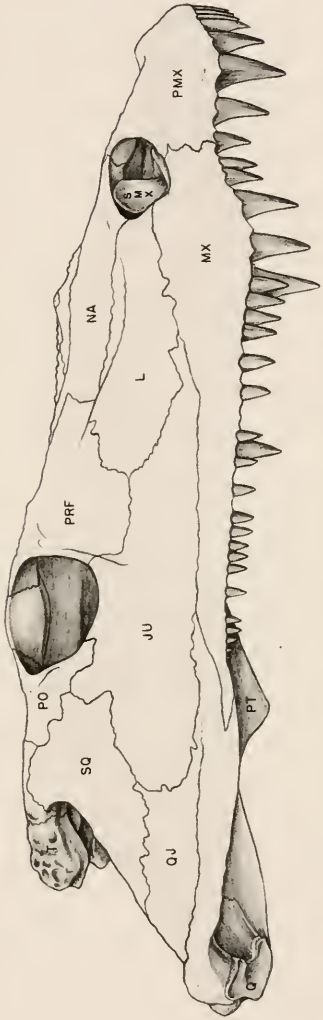
PT
BSPH
O
STPD

PLATE 4

PLATE 4

Eryops megacephalus. a. Lateral view of skull with mandible in position. x 3/10. b. Lateral view of skull without mandible. M.C.Z. 1129. x 3/10.

a

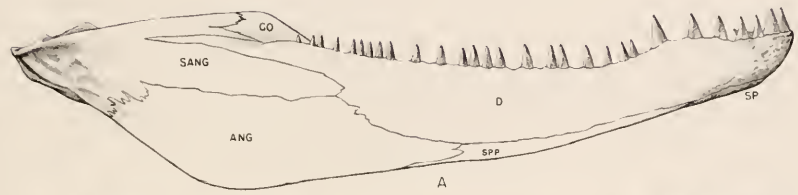


b

PLATE 5

PLATE 5

Eryops megacephalus. A. Jaw, lateral view. x 1/4. B. Jaw, mesial view. x 1/4. C. Jaw, dorsal view. x 1/4. D. Jaw, ventral view. x 1/4. E. Jaw, posterior view. x 1/2.


CO
SANG
D
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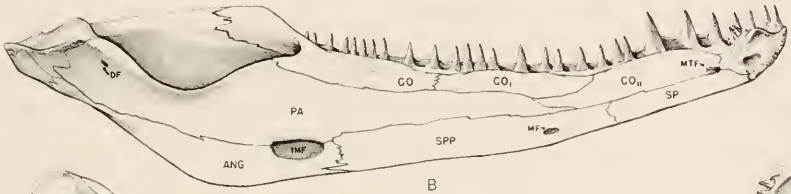
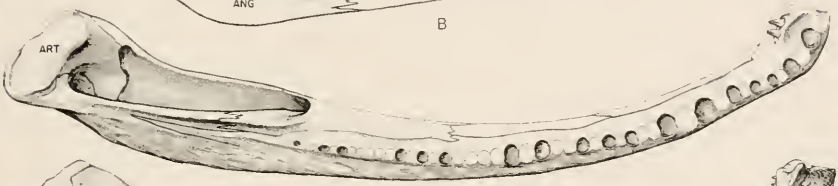
SPP

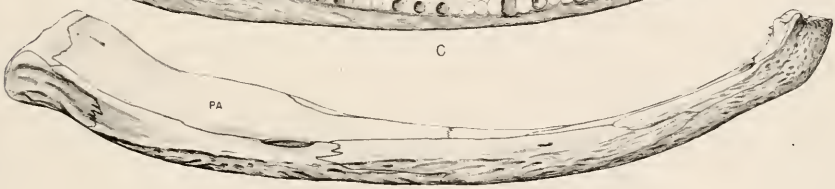
A


DF
CO
CO$_I$
CO$_{II}$
MTF$_I$
SP
PA
IMF
SPP
MTF$_{II}$
ANG

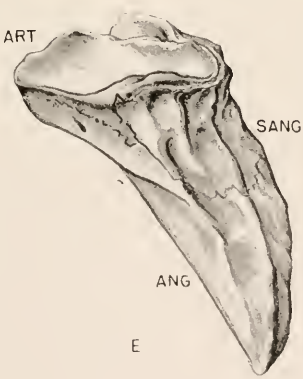
B


ART

C


PA

D

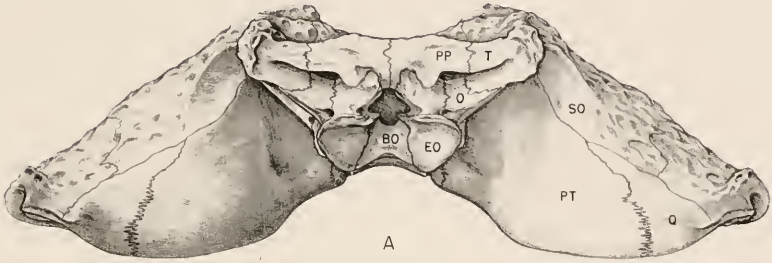

ART
SANG
ANG

E

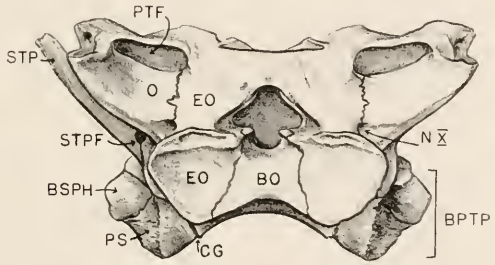
PLATE 6

PLATE 6

A. Skull, posterior view. x 3/10. B. Braincase, posterior view. x 1/2. C. Stapes. x 1/2. A. posterior view of right stapes; B. anterior view of right stapes; C. base of stapes.


PP
T
O
SO
BO
EO
PT
Q

A


PTF
STP
O
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STPF
N X
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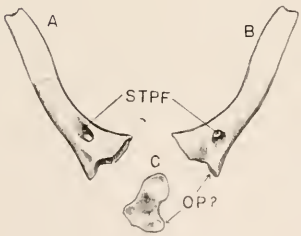
BO
BSPH
BPTP
PS
CG

B

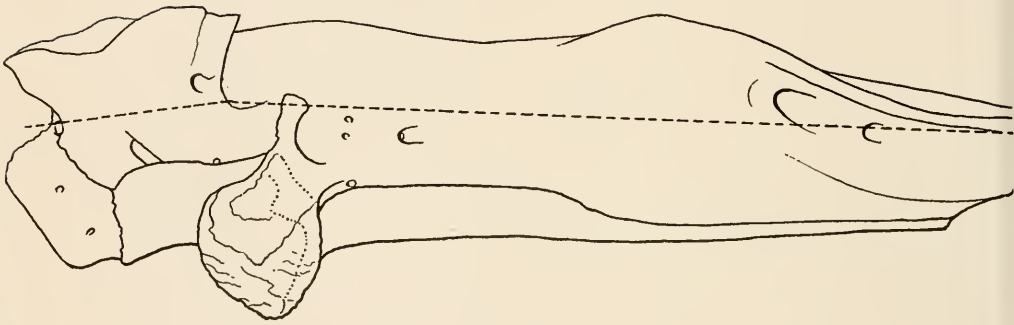

A
B
STPF
C
OP?

C

PLATE 7

PLATE 7

Eryops megacephalus. A. Braincase in dorsal view. B. Ventral portion of horizontally sectioned braincase in dorsal view. The plane of the section is shown by an interrupted line in the figure below. C. Detail of the basisphenoid. The otics, the laterosphenoid region and the dorsum sellae have been removed to expose the area of origin of some of the rectus muscles of the eye. x 1/2.



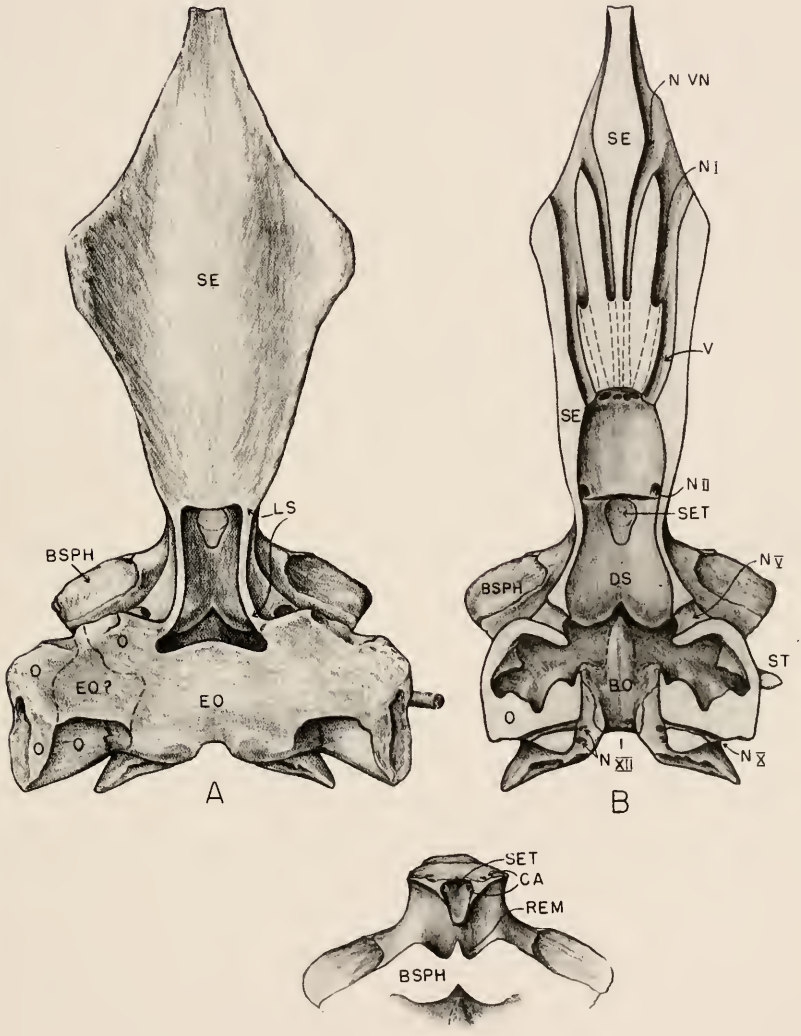
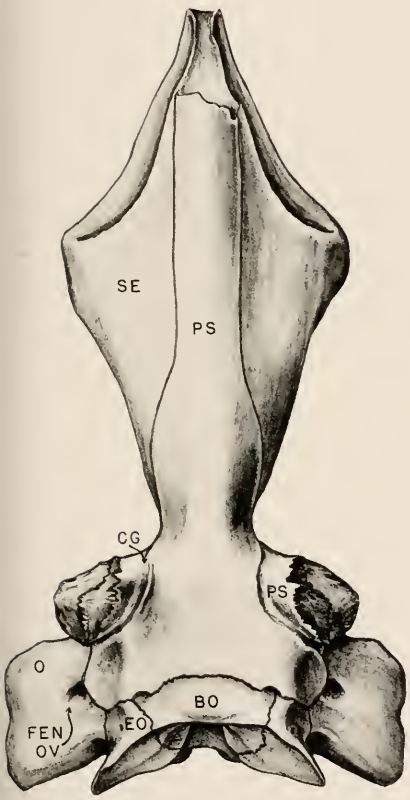

SE
LS
BSPH
O
O
EQ?
EO
O
O
A
N VN
SE
N I
V
SE
N II
SET
N V
BSPH
DS
ST
BO
O
N XII
N X
B
SET
CA
REM
BSPH
C

PLATE 8

PLATE 8

Eryops megacephalus. a. Braincase in ventral view. b. Dorsal portion of horizontally sectioned braincase in ventral view. The plane of the section is indicated in the explanation of Plate 7B. x 1/2.


SE
PS
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O
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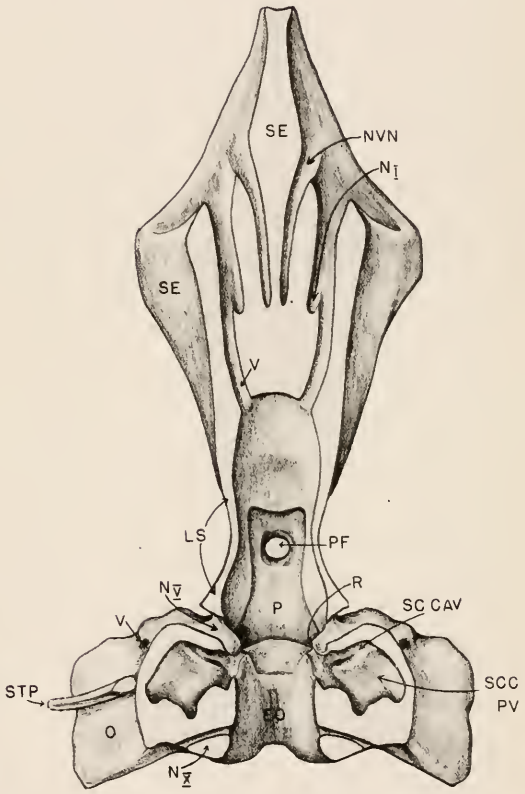
FEN
OV
EO

a

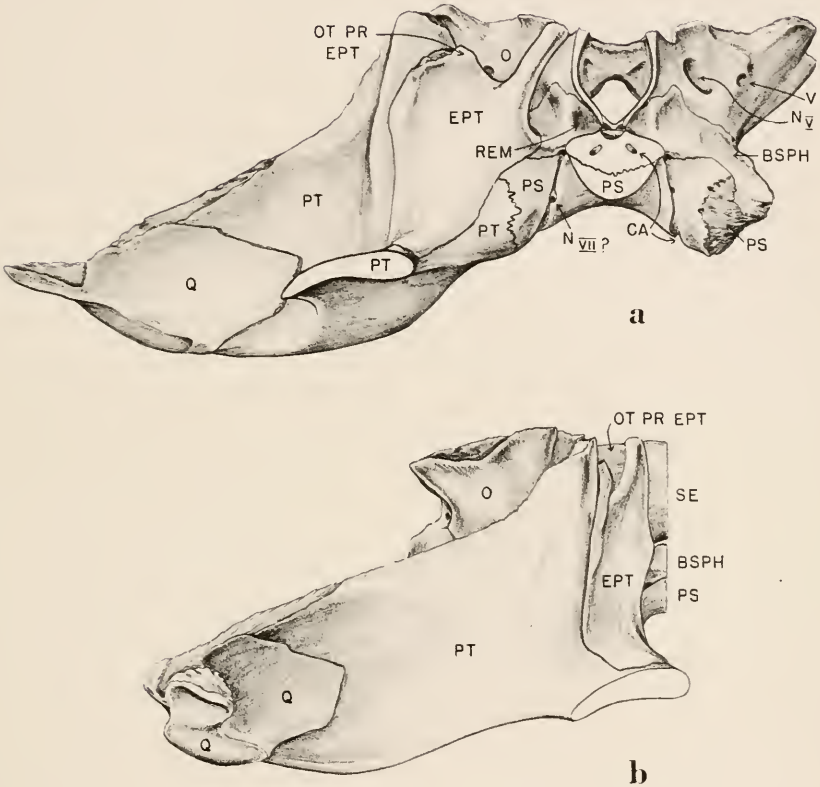

SE
NVN
N I
SE
V
LS
PF
N V
R
P
SC CAV
V
STP
SCC
PV
O
EO
N X

b

PLATE 9

PLATE 9

Eryops megacephalus. a. Anterior view of braincase and posterior portion of the right palatoquadrate complex. The sphenethmoid region has been cut away and the braincase is shown in a transverse section which passes through the anterior part of the sella turcica. The transversely sectioned part of the pterygoid is cut just in back of its descending process. b. Lateral view of braincase and posterior part of the right palatoquadrate complex. x 1/2.


OT PR
EPT
O
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REM
PS
PS
PT
PT
PT
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N VII ?
CA
V
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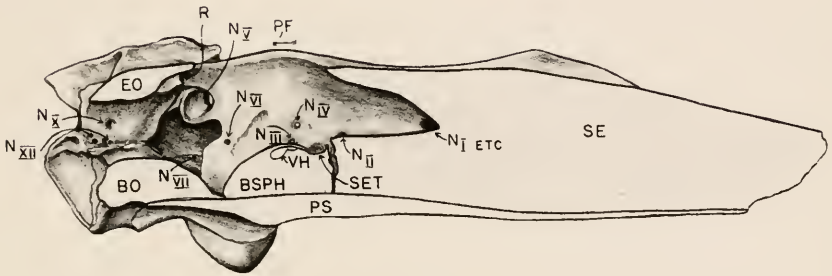
BSPH
PS
a
OT PR EPT
O
SE
BSPH
EPT
PS
PT
Q
Q
b

PLATE 10

PLATE 10

a. Braincase in lateral view. b. Left half of braincase as seen from the median section.


R
N V
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EO
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N IV
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N XII
VH
N I ETC
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N VII
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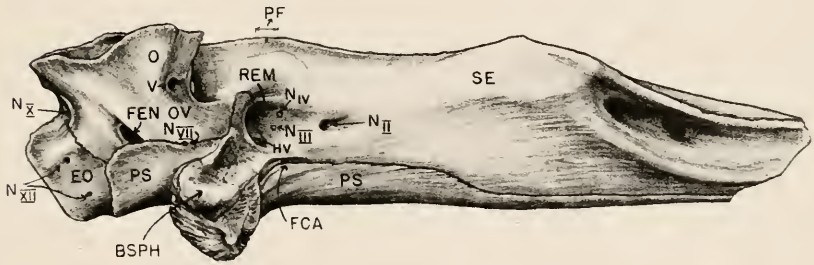
SET
PS

b

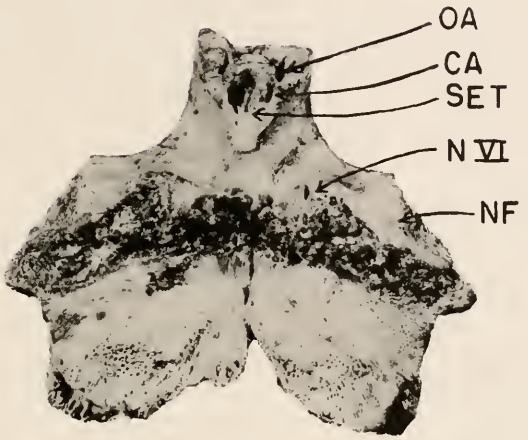

PF
O
V
REM
SE
N IV
N X
FEN OV
N VII
N II
N III
HV
EO
PS
PS
N XII
FCA
BSPH

a

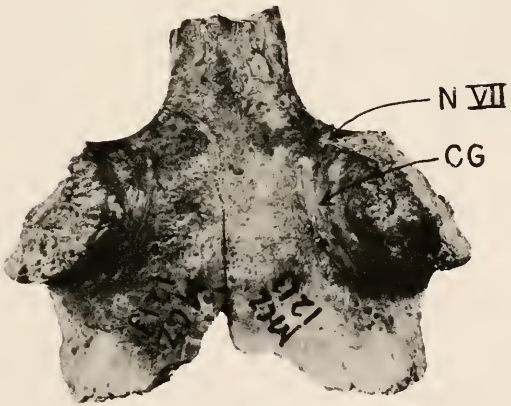
PLATE 11

PLATE 11

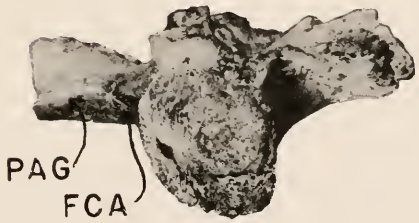
Eryops sp. a. Dorsal view of the basisphenoid and posterior portion of the parasphenoid. b. Ventral view. c. Lateral view. x 1.



a



b

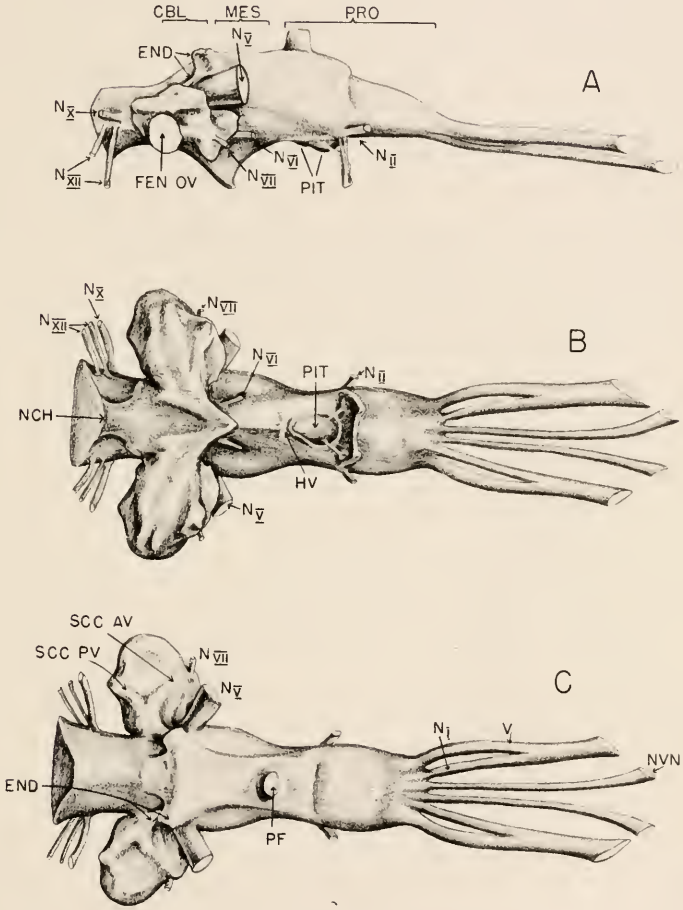


c

PLATE **12**

PLATE **12**

Eryops megacephalus. Endocranial cast. A. Lateral view. B. Ventral view. C. Dorsal view. x 1/2.


CBL
MES
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END
N V
N X
N XII
FEN OV
N VII
N VI
PIT
N II
A
N X
N XII
N VII
N VI
PIT
N II
NCH
HV
N V
B
SCC AV
SCC PV
N VII
N V
N I
V
NVN
END
PF
C

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AT HARVARD COLLEGE
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REVISION OF THE AFRICAN TERRAPIN OF THE FAMILY PELOMEDUSIDAE

BY ARTHUR LOVERIDGE

...brary
Museum of Comparative Zoology
Harvard University

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No. 6.—*Revision of the African Terrapin of the Family Pelomedusidae*

By Arthur Loveridge

It has long been obvious to taxonomists that, owing to inadequate material, the key furnished by Boulenger (1889a, p. 192) for distinguishing members of the genus *Pelusios* proved so misleading as to result in the greatest confusion for half a century, as is shown by the voluminous literature. Indeed, the only attempt to straighten out the situation was that of Siebenrock (1903d), who failed, on account of the alternative characters which he selected proving no less variable than those of Boulenger which he rejected.

Recent nomenclatorial changes necessitated my investigating the status of certain names in order to ascertain which were applicable to three species of the family collected on my last visit to East Africa. I found the whole situation so involved that eventually I decided on the present revision, which is humbly offered in the hope that its conclusions will form a stable basis that will stand the test of time.

The most important change is the rejection of *niger* from the West African fauna, except as a synonym of *subniger* Lacépéde, for the '*niger*' of Boulenger and subsequent authors is a synonym of *gabonensis* Duméril, and nothing to do with the *niger* of Duméril & Bibron who believed, and probably correctly, that their 180 mm. type came from Madagascar. I am deeply indebted to Mons. Angel for detailed notes on the type of *niger*, without which I could not have settled the point.

I take this opportunity of thanking Mons. Angel (Paris), Dr. Oscar de Beaux (Genoa), Dr. L. D. Brongersma (Leiden), Dr. P. R. Reveilliod (Geneva), Dr. L. Forcart (Basel), Mr. G. Netting (Pittsburgh), and Mr. H. W. Parker (British Museum) for the loan of material or for answering my queries respecting material in their care. And by no means least, Mr. Vesey FitzGerald of the Malay States, who took the trouble to secure a series of *seychellensis*, which he has presented to the Museum of Comparative Zoölogy.

No attempt has been made to complete bibliographical references prior to 1889. From that date I have attempted to list all those found in a search through 1,500 papers on African herpetology. I hope that omissions will not prove numerous. A synopsis of the information culled from this literature, is given for each species, though in the fields of anatomy and physiology only the barest reference is made.

Taxonomic changes. Many earlier synonymizings are confirmed, while the following alterations in nomenclature are made for the first time.

Pelomedusa galeata orangensis Hewitt
= *Pelomedusa s. subrufa* (Lacépède).
Pelomedusa galeata devilliersi Hewitt
= *Pelomedusa s. subrufa* (Lacépède).
Pelomedusa galeata damarensis Hewitt
= *Pelomedusa s. subrufa* (Lacépède).
Pelomedusa subrufa wettsteini Mertens
= *Pelomedusa s. subrufa* (Lacépède).
Emys olivacea Schweigger is revived as
Pelomedusa s. olivacea (Schweigger).
Pelomedusa gasconi Rochebrune
= *Pelomedusa s. olivacea* (Schweigger).
P. g. var. *disjuncta* Vaill. & Grand.
= *Pelomedusa s. olivacea* (Schweigger).
Sternothaerus niger Blgr. (*non* D. & B.)
= *Pelusios gabonensis* (A. Duméril).
Sternothaerus derbianus Gray = *Pelusios subniger* (Lacépède).
Sternothaerus oxyrhinus Boulenger = *Pelusios subniger* (Lacépède).
S. nigricans seychellensis Siebenrock = *Pelusios subniger* (Lacépède).

Origins. It would appear to me that the Pelomedusidae entered Africa from the north or northwest with *Pelomedusa s. olivacea* (Senegal to Eritrea), if recognisable, as the oldest living form, giving off *P. s. subrufa* (Sudan to Cape) which in turn produced *Pelusios adansonii* (Senegal to the Nile). The latter would appear to have given rise to the handsomest member of the genus *P. gabonensis* (Liberia to Congo) an inhabitant of the West African rainforest region. The widespread *P. subniger* may also be assumed to have risen from *adansonii* or some common ancestor, and in the east developed the handsome *sinuatus* (Somaliland to Natal).

Designation of Headshields. The shields called frontals by Boulenger, prefrontals by some other authors, I designate supraorbitals. The huge shield which he called a parietal, appears to have been formed by fusion of the frontal with the parietals, as may be deduced from the frequency with which grooves appear on its posterior half, indicative of the lines of fusion. This shield I call the frontal, it is flanked on either side by a large temporal which is subject to subdivision.

Description. At the risk of monotonous repetition, I have drafted somewhat detailed descriptions based on the material at my disposal, augmented in footnotes by further variations observed by other workers. This has been done because some recent authors have been

apt to attach undue importance to extremely variable characters, often those which have long been known to be sexual or subject to alteration with age. The descriptions now drawn up show that most of the species run the whole gamut of such variations.

Localities. Rochebrune's (1884a) localities have been omitted as untrustworthy. Otherwise I have attempted to list, after each species, all the localities from the literature for the past fifty years, except such as have been subsequently shown to be based on erroneous identifications, now transferred to their appropriate species. I should have liked to cite the author responsible for each locality, this, however, would have added enormously to the burden of printing.

Political areas have been arranged on a definite geographical plan, the place names alphabetically within their respective political areas.

Family PELOMEDUSIDAE

Freshwater Terrapin

Semiaquatic tortoises covered with horny shields overlying the bony plates of a more or less depressed box-like exoskeleton; head and neck completely retractile within the shell by lateral flection; nostrils at end of snout; jaws covered with a horny beak; dentary single; palatine bones in contact; no nasals; prefrontals in contact; temporal region not roofed over; a bony temporal arch; no parietosquamosal arch; digits moderately elongate; hind foot webbed; five or four[1] claws.

For detailed structural definition of the Pleurodira, in which superfamily the Pelomedusidae are included, see Boulenger, 1889a, Catalogue of Chelonians . . . in the British Museum, pp. 187–190.

Range. Africa, Seychelles, Madagascar and South America.

Key to the Genera

Anterior lobe of plastron immovable; pectoral shields participating equally with abdominals on bridge; plastral fenestration persisting till late in life; mesoplastra small and lateral . . . . . *Pelomedusa* (p. 470)

Anterior lobe of plastron movable in adult; pectoral shields almost excluded from bridge by abdominals; plastral fenestration closed very early in life; mesoplastra extending right across the plastra . . . . . *Pelusios* (p. 481)

[1]Four on hind foot of Malagasy *Erymnochelys* and S. American *Podocnemis*.

Genus Pelomedusa

1830. *Pelomedusa* Wagler, Nat. Syst. Amphib., p. 136 (type *galeata* = *subrufa*).
1831. *Hydraspis* Gray (part), Syn. Rept., p. 39 (type *Hydraspis longicollis*).
1835. *Pentonyx* Duméril & Bibron, Erpét. Gén., **2**, p. 389 (type *capensis* = *subrufa*).

Skull without supratemporal roof; quadrato-jugal widely separated from parietal; upper jaw with very indistinct median ridge on alveolar surface; between the orbits are a pair of supraorbital shields separated by a longitudinal suture and followed by a large frontal flanked by temporals; plastron narrow, without hinge; mesoplastral bones small, lateral, wedged in between the hyoplastra and hypoplastra; plastral fenestration persisting till late in life; digits very short, mostly with 2 phalanges, feet with 5 claws.

Range. Africa south of the palaearctic zone; Madagascar.

Remarks. A single species (*Pelomedusa subrufa*) with a poorly defined race occurring along the northern fringe of its range. Scattered individuals possessing the character of the northern form crop up within the range of typical *subrufa*, but should not be considered to invalidate the recognition of the northern form unless they prove to be far more numerous than our present information would indicate.

Key to the Races

Pectoral shields in contact on the median line of the plastron . . . . . *s. subrufa* (p. 470)
Pectoral shields separated on the median line of the plastron . . . . . *s. olivacea* (p. 480)

Pelomedusa subrufa subrufa (Lacépède).

1788. *La Roussatre* Lacépède, Hist. nat. Quadrup. ovip. Serpens, **1**, p. 173, pl. xii: "de l'Inde" as Sonnerat coll. restr. to Cape.
1789. *Testudo subrufa* Lacépède, Hist. nat. Quadrup. ovip. Serpens, **2**, Synopsis methodica (a table in which binomials are employed.)
1789. Bonnaterre, p. 27.
1802. Daudin, p. 132.
1792. *Testudo galeata* Schoepff, Hist. Testud., p. **12**, pl. iii, fig. 1: "India orientali, Carolina" restr. to Cape Flats, S. Africa.
1802. Daudin, p. 136.
1798. *Testudo Badia* Donndorff, Zool. Beytr. Linn. Natur., **3**, p. 34: No locality. Based on Lacépède's "*La Roussatre.*"
1814. *Emys galeata* Schweigger, p. 38.
1814. *Emys subrufa* Schweigger, p. 39.

1830. *Pelomedusa galeata* Wagler, p. 136, pl. ii, figs. 36–43.
1848. Peters, p. 492, pl. xvii, figs. 1–3.
1849. Smith, App., p. 1.
1862. Strauch, p. 150.
1865. Strauch, p. 111.
1869b. Peters, p. 657.
1870. *Steindachner, p. 326.
1880a. Boulenger, p. 146.
1880b. Peters, p. 509.
1881b. *Boettger, p. 410.
1881c. Boettger, p. 535.
1882a. Peters, p. 6.
1884a. *Rochebrune, p. 22.
1887a. Bocage, p. 202.
1887b. Boettger, p. 140.
1888a. Boettger, p. 13.
1889. Boettger, p. 296.
1889a. *Boulenger, p. 197.
1890a. *Müller, p. 296.
1890. Strauch, p. 103.
1893a. Boettger, p. 14.
1893b. Boettger, pp. 113, 122.
1894a. Boettger, p. 88.
1894. Fleck, p. 83.
1894. Günther, p. 85.
1895a. Bocage, p. 5.
1895b. *Boulenger, p. 531.
1895. Jeude, p. 227.
1896a. Bocage, p. 97.
1896a. *Boulenger, p. 546.
1896b. Boulenger, p. 6.
1896c. *Boulenger, p. 16.
1896e. Boulenger, p. 213.
1897g. Boulenger, p. 277.
1897. Siebenrock, p. 247.
1898. Jeude, p. 9.
1898a. Vaillant, p. 135.
1898. Sclater, p. 97.
1898. Tornier, p. 282.
1899. Siebenrock, p. 566.
1900a. Mocquard, p. 94.
1900b. Tornier (part), p. 583.
1901. Gadow, p. 391.

* These should be transferred in whole or in part to *olivacea* should that race prove to be recognisable.

1901c. Tornier, p. 67.
1902d. Boulenger, p. 445.
1902a. Mocquard, p. 6.
1902b. Tornier, p. 580.
1902c. Tornier, p. 665.
1903e. Boulenger, p. 217.
1903a. Siebenrock, p. 255.
1904. Peracca, p. 1.
1905. Neumann, p. 390.
1905c. *Tornier, p. 366.
1906a. Mocquard, p. 480.
1906b. Siebenrock, p. 40.
1907j. Boulenger, p. 483.
1907. Lönnberg, p. 2.
1908. Werner (1907), p. 1826.
1909. Siebenrock, p. 561.
1910. Meek, p. 414.
1910b. Nieden, p. 7. (text apparently transposed with that of *gabonensis*)
1910. Siebenrock, p. 718.
1910. Vaillant & Grandidier, pp. 26, 53, pl. xx, figs. 1–2, pl. xxi, fig. 1.
1910a. Werner, p. 305.
1911c. Boulenger, p. 162.
1911. Lampe, p. 148.
1911b. Sternfeld, p. 411.
1911d. Sternfeld, p. 53, figs. 65–66.
1912c. Sternfeld (part), p. 201.
1912b. Werner, p. 469.
1913. Boettger, p. 319.
1913c. Nieden, p. 64.
1915. Rawitz, p. 670.
1917. Sternfeld, p. 414.
1919. Schmidt, pp. 415, 598, 601, fig. 1.
1921d. Loveridge, p. 52.
1922a. Angel, p. 39.
1922. Kaudern, p. 449.
1923b. Calabresi, p. 156.
1923g. Loveridge, pp. 930, 932.
1924b. Loveridge, p. 2.
1924a. Werner, p. 266.
1925b. Flower, p. 933.
1926a. Mertens, p. 152.
1927. Calabresi, pp. 20, 38.
1928. Cott, p. 952.

*These should be transferred in whole or in part to *olivacea* should that race prove to be recognisable.

1928d. Loveridge, p. 51.
1928b. *Scortecci, p. 336.
1928m. Witte, p. 45.
1929. Lindholm, p. 288.
1929h. Loveridge, p. 16.
1929. Rose, p. 185, fig. 123.
1930a. *Scortecci, p. 215.
1931d. Angel, p. 551.
1931. Mann, p. 366.
1931. Monard, p. 110.
1931. Power, p. 48.
1932b. Parker, p. 340.
1933. Flower, p. 752.
1933h. Loveridge, p. 211.
1933. Schmidt, p. 3.
1933m. Witte, p. 67.
1934. Pitman, p. 307.
1935b. FitzSimons, p. 307.
1935. Hewitt, p. 325.
1936. Cowles, p. 6.
1936h. Loveridge, p. 19.
1936j. Loveridge, p. 225.
1937. Buxton, p. 102.
1937f. Loveridge, pp. 489, 492, 495.
1937b. Monard, p. 146.
1938. FitzSimons, p. 155.
1939b. FitzSimons, p. 20.
1940a. Scortecci, p. 6.
1831. *Hydraspis subrufa* Gray, p. 39.
1835. [1]*Pentonyx Capensis* Duméril & Bibron, Erpét. Gén., **2**, p. 390, pl. xix, figs. 2–2b: Cape of Good Hope, etc. restr. by Mertens.
1860. A. Duméril, p. 163, pl. xiii, fig. 3.
1844. *Pelomedusa subrufa* Gray, p. 38.
1855. Gray, p. 53.
1867a. Steindachner, p. 6.
1870. Gray, p. 81.
1872a. Gray, p. 24.
1873b. Gray, p. 71.
1888a. Günther, p. 50.
1934a. Mertens, p. 10.
1937e. Hewitt, p. 14, pl. iv, figs. 1–3; pl. ivA, fig. 1; pl. xxvii, fig. 3.
1849. *Pentonyx americana* Cornalia, Vert. syn. Mus. Mediolan., p. 13: "New York" probably a South African specimen.

*These should be transferred in whole or in part to *olivacea* should that race prove to be recognisable.
[1] This specimen also served as the type of *Testudo subrufa* Lacépède.

1855. *Pelomedusa Mozambica* "Peters M.S.S. 1848" Gray, Cat. Shield Rept., p. 53: Mozambique (*nomen nudum*).
1856. *Pelomedusa mossambicensis* "Peters" Lichtenstein & V. Martens, Nomenclator Rept., p. 2: Mozambique (*nomen nudum*).
1863a. *Pelomedusa nigra* Gray, Ann. Mag. Nat. Hist. (3), **12**, p. 99: Natal.
1870. Gray, p. 81.
1873b. Gray, p. 72.
1872. *Hydraspis galeata* Gray, in Sowerby & Lear, p. **7**, pls. xlix–l.
1935. *Pelomedusa galeata subrufa* Hewitt, p. 326.
1935. *Pelomedusa galeata orangensis* Hewitt, Rec. Albany Mus., p. 332, pl. xxxi, fig. 3, pl. xxxii, figs. 3–4: ? Kimberly, Cape Province.
1935. *Pelomedusa galeata nigra* Hewitt, p. 335, pl. xxxii, figs. 1–2.
1935. *Pelomedusa galeata devilliersi* Hewitt, Rec. Albany Mus., p. 337, pl. xxxi, figs. 2, 4: Besondermeid, Steinkop, Namaqualand.
1935. *Pelomedusa galeata damarensis* Hewitt, Rec. Albany Mus., p. 338, pl. xxxiii, figs. 1–4: Quickborn, nr. Okahandja, S. W. Africa.
1935. *Pelomedusa galeata galeata* Hewitt, p. 342, pl. xxxiv, figs. 3–4.
1937a. *Pelomedusa subrufa wettsteini* Mertens, Zool. Anz., **117**, p. 141, figs. 1, 4: Majunga, West Madagascar.
1937b. *Pelomedusa subrufa damarensis* Mertens, p. 5.
1937d. *Pelomedusa subrufa subrufa* Mertens, p. 3.
1937e. *Pelomedusa subrufa orangensis* Hewitt, p. 14.

Names. Marsh Terrapin, Helmeted Terrapin (English); *njaba* (Ganda); *nguru* (Kitosh); *malwala* (Gogo); *camba na madsi* (at Rios de Sena); *nambe* (at Querimba); *fudue* (at Quilimane); *isifudu* (in Umzumbe Valley); *ufodo* (Fingo, but not specific); *ofiufiu* (at Kalukembe); *kitio* (at Quisange).

History. Mertens (1937, p. 139) has shown that the name *galeata*, so long employed for the marsh terrapin, is antedated by *subrufa* of Lacépède, not of Daudin.

Description. Head broad, snout short; a pair of supraorbital shields[1] followed by a very large frontal, flanked by a pair of temporals; narrowest interorbital width much shorter than the longitudinal suture between the supraorbitals; upper jaw angularly rounded; chin with, rarely without[2], a pair of small barbels; carapace depressed, its height included in its length from 2.50 to 3.50 times, slightly elongate, its posterior margin rounded or very slightly serrate; vertebral shields 5, more or less obtusely keeled, first vertebral largest, broader than long, fourth also broader than long; costals 4, very rarely 5[3]; marginals 22,

[1] Transversely divided in a Gomodimo terrapin (FitzSimons, 1935b, p. 307).
[2] Absent in specimens from Nkate (FitzSimons, 1935b, p. 307).
[3] 4 on left and 5 on right in Oda example (Tornier, 1905c, p. 366).

very rarely 24; supracaudals 2; plastron very much smaller than the opening of the carapace; anterior lobe truncate, broader than posterior which is more or less angularly and deeply notched; intergular much longer than a gular, its sides straight[1]; humerals 2, very rarely 4[2]; pectorals forming a median suture of variable length; pectoral and abdominal shields nearly equally developed on the bridge; width of bridge contained about 2½ times in the width of the plastron.

Anatomy. The skull has been described by Siebenrock (1897, p. 247), and later (1899, p. 566) the glottis; the musk gland by Peters (1848, p. 492), the alimentary canal by Vaillant & Grandidier (1910, p. 55), and the nervous system by Rawitz (1915, p. 670).

Coloration. Above, head and limbs dark olivaceous with, or without darker and lighter vermiculations; carapace light olive, yellow brown, or dark brown, uniform or with the margins of the shields edged with black; in young, which are olive green, the marginals are edged with creamy yellow alternating with black. Below, chin and throat white to yellowish white; plastron yellowish or horn colour with brown or black infuscations about the edge and along the sutures of the shields, or plastron entirely black.

In East Africa the only specimens seen which had entirely black plastrons came from the Mabira Forest and near Mount Elgon; perhaps, therefore, such colouring occurs in forested, or recently deforested, areas, while yellow plastrons are associated with more arid regions?

South African specimens whose plastrons have a maroon or dark red tinge, may supposedly be the result of staining from laterite soil, as is stated to be the case with Natal and Malagasy *subniger*.

Peters (1882a, p. 6) remarks that the iris has a silver gleam and is grey towards the periphery. Mann (1931, p. 366) shows that both the narrow circumpupillary zone as well as the narrow peripheral zone are covered with silver pigment while the vessels of the iris have much chocolate pigment in their walls obscuring the blood colour. Hewitt (1937e, p. 11) remarks that the pupil is circular and the iris has a yellow margin. Possibly based upon preserved material?

Measurements. Length of carapace of a ♂ from Tanganyika Territory, 200 mm., breadth 135 mm., height 68 mm.; length of carapace of a ♀ from Dodoma 161 mm.[3], breadth 128 mm., height 63 mm. Both surpassed by South African measurements furnished by Hewitt

[1] Pyriform in some South African specimens (Hewitt, 1935, p. 326).
[2] In an aberrant individual from Ngare na Nyuki (Lönnberg, 1907, p. 2).
[3] The ♀ of 179 mm. recorded by me (1933h, p. 212) proves to be a ♂.

(1935, p. 331) of a ♂ from Kingwilliamstown district (presumed) measuring 325 mm., breadth 245 mm., and a ♀ from Albany district (presumed) measuring 241.5 mm., breadth 180 mm. A ♂ from Khor Arbat with a carapace length of 200 mm. weighed 1.25 kilos (2.75 lbs.) according to Flower (1933, p. 753).

Sexual dimorphism. Males, recognisable by their longer tails, have narrower shells than females, while their claws are said by Werner (1910a, p. 305) to be stronger, not longer. Usually also they exhibit a slight depression in the posterior third of the plastron, the notch of its posterior lobe is not a guide. Hewitt (1935, p. 327) cites other differences which are individual rather than sexual, *cf.* contradictions regarding mesial notch and pear-shaped intergular.

Breeding. The only accounts of ovipositing are those published by Hewitt (1937e, p. 13), the most detailed being condensed as follows. One warm November evening, near Grahamstown, Miss. N. White surprised a female laying in a hole which had a surface diameter of 2½ inches, and a depth of from 4 to 5 inches terminating in a chamber slightly larger than a tennis ball. The surrounding ground was sun-baked, hard and dry, but the site had been softened by the terrapin discharging cloacal water, two other spots where an attempt to dig had been abandoned, were found within a couple of yards.

There were already 5 eggs in the hole and the terrapin continued depositing others at the rate of about one per minute until a total of 14 had been laid. Each egg had a dent in its tough membranous surface, and was covered with slime which took about an hour to dry. A noteworthy feature was the absence of any musky odour during ovipositing, though when the site was revisited next morning a foul smell was immediately apparent. The hole had been filled in with the excavated muddy soil and flattened, so that once sunbaked it would have escaped detection. An egg measured 37 x 25 mm.

Schmidt (1933, p. 3) records a hatchling, from Angola, which had already lost its egg tooth, as measuring 25 mm. in length and 19.5 mm. in breadth; the smallest East African (Guaso Nyiro) terrapin which I have seen had a carapace length of 34 mm., breadth 27 mm. and height of 11 mm.

Longevity. 16 years, 10 months, 11 days (Flower, 1925b, p. 933).

Diet. Spiders, grasshoppers—one of which was warningly coloured in black and yellow, stink ants (*Paltothyreus tarsatus*) were readily taken, the latter being snapped in half; the head and thorax crunched first, then the abdomen (Loveridge). Earthworms and mealworms (Boettger).

According to Rose (1929, p. 186) large prey is not killed and eaten quickly, these terrapin having an unpleasant habit of seizing a hapless frog by a hind foot, then, with forward thrusts of the claws, shredding the unfortunate creature's limb to tatters. In captivity they ate chopped meat, tadpoles, fish, crabs, snails and even weeds.

W. Cloete (in Hewitt, 1937e, p. 12) adds prickly-pear fruit to their dietary, saying: "when the fruit dropped they visited the tree and carried the fruit into the water to eat." They are partly nocturnal, being a nuisance to eel fishermen by taking their bait. After prolonged drought marsh terrapin become thin and emaciated and according to Bowker (in Hewitt) will catch small ducklings and goslings or congregate to feed upon a dead sheep should one fall into the dam where they live.

Enemies. Marsh terrapin are eaten by natives at Quissange, Angola, also by the Hereros. They are dug from their retreats by ratels and preyed upon by jackals and eagles, the latter tearing out the hinder part of the plastron of small examples according to Bradfield (in Hewitt, 1935, p. 340). Angel (1922a, p. 39) records the recovery of a small terrapin, under 40 mm. in length, from the stomach of a sea eagle (*Haliaëtus vocifer*) in the French Sudan.

Defence. When seized it defends itself effectively by squirting the contents of its cloaca at its assailant (Boettger, 1881b, p. 410). Apart from their offensive musky odour, emanating from the secreting glands by four minute pores close to the carapace opposite the fourth and eighth marginal shields, these terrapin chiefly rely on withdrawing the head and limbs within the shell, though the protection afforded is less effective than is the case with the other species of African terrapin and tortoises. The long neck necessitates the head lying sidewise, from which position the fishy eye of the reptile continues to appraise the extent of the danger.

Aestivation. When marshes and ponds commence drying out at the onset of the dry season, these terrapin dig themselves into the mud by an outward and upward movement of the hind limbs. Buxton (1937, p. 102) *thinks* that in the prolonged droughts of Turkanaland they must remain buried deeply in the sandy water-courses for years at a time. At Voi, on April 22, I encountered many in such a water-course after a heavy downpour, one of several inaugurating the arrival of the big rains. At Dodoma, during July, a hundred of these terrapin which I had been keeping in a tank, either from a sense of overcrowding—though food was abundant, or warned by some seasonal instinct—for the rains had ended six weeks before, insisted with one accord in

clambering out and piling themselves against the wire netting surrounding their inclosure. Returning them to their tank proved futile so for a week they preferred to stay exposed to the cold winds which rose at night, until I removed them indoors and packed them in crates of straw. At Mtali's, near Mkalama, on October 20, after heavy rain storms on the two preceding days, one of these terrapin was encountered at 8.15 a.m. endeavouring to dig itself into the middle of a hard though sandy road. At Mangasini, on December 12, an initial downpour of the small rains commenced at 6 p.m. and lasted till noon on the following day. This resulted in the emergence of many aestivating terrapin, numbers of which I captured in a dry water course that had held a torrent only the night before.

In Somaliland marsh terrapin aestivate from January to March and from July to September (Gadow, 1901, p. 391). In South Africa both aestivation and hibernation takes place for, should the dams and vleis dry up, they are said to leave them to bury, reëmerging after heavy thunderstorms.

Hibernation. During the South African winter, marsh terrapin usually leave the water from May to August to bury themselves in soft soil or among dead leaves beneath trees, but at Skietop, near Sidbury, with a surface temperature of from 52° to 58° in June, they remain in the dams throughout the year. (Hewitt, 1937e, p. 11.) Fleck (1894, p. 83) refers to digging them from the mud in winter in South-West Africa.

Habits. In the South African summer they like to sun at the water's edge or, on occasion, to climb the branches of overhanging trees so as to bask a couple of feet above the water, into which they retreat at the slightest alarm, their sharp eyesight enabling them to detect an intruder at some distance (Hudson, in Hewitt, 1937e, p. 12). In the tropics basking is rarely indulged in by these terrapin, though I have occasionally seen one sunning in the early morning at the edge of a water hole.

Habitat. Though quite at home and active on land, the marsh terrapin may be seen to best advantage in water where it swims and dives with confident agility, remaining below for long periods without coming to the surface to breathe. Owing to their ability to exist in swamps and small bodies of water from the coastal plain to the upland savannas at 6,000 feet, these terrapin have a distinct advantage over the so-called soft-shelled turtles whose distribution is restricted to the lakes and larger rivers.

Localities. **Anglo-Egyptian Sudan:** El Obeid; Gamilab Hills s. of Suakin; Gebel Moya near Sennar; Khoi Arbat near Port Sudan; Wad Medani; White Nile between Fashoda and Renk. **Ethiopia:** Abdallah; Ela Gura; Gonda; west of Juba River; Meddo Erelle; Oda*; Sabarguma; Sereba Ghattas. **British Somaliland:** Buran dist.; Erigavo dist. **Italian Somaliland:** Boran; Djugi; Giblene; Stagno Saha.* **Uganda:** Bussu; Kabulamuliro. **Kenya Colony:** Bulessa; Guaso Nyiro; Kapiti Plains; Kirui's in Kitosh; Lukenya Hills; Moyale; Nairobi; Sotik; Voi. **Tanganyika Territory:** Dodoma; Iringa; Kasanga; Kikamero; Kilimatinde; Lake Eyasi to Isanssu; Lake Victoria; Luguo; Mahaka; Mangasini; Masai Nyika; Mbulu; Mtali's near Mkalama; Mtita's near Dodoma; Mukwese; Ngare na Nyuki; Nzinga; Pumbo near Mondo; Ruaha River; Tabora; Tanga; Ukerewe Island. **Mozambique:** Lumbo; Quelimane; Querimba; Tete. **Nyasaland:** Livingstonia. **Northern Rhodesia:** (*fide* Pitman). **Southern Rhodesia:** Sabi River at Birchenough Bridge. **Bechuanaland Protectorate:** Gomodino Pan; Gomodimo to Koke; Kuruman; Lobatsi; Metsimaklaba River; Nkate Pan; Zweizwe River. **Transvaal:** Junction of Comati and Crocodile Rivers; Naawpoort[1] (M.C.Z.); Tuefloop on north slope Drakensburg. **Natal:** Uzumbwe Valley; Winkle Spruit. **Orange Free State:** Emmaus; Thabanchu. **Cape Province:** Besondermeid near Steinkop; Bushman's River; Cape Peninsula; Deelfontein; Gleniffer near Kei Road; Graff Reinet; near Grahamstown; Great Fish River; Kimberly; Malmsbury; Mortimer; Port St. Johns (M.C.Z.); Queenstown; Skietkop near Sidbury; Sunday's River; Warrenton. **South-West Africa:** Aroab (M.C.Z.); Aus; Chamis; Gochaganas S. of Windhuk; Hoffnung; Mookane; Namutoni; Oas; Okonjati; Possession Island,[1] Quickborn near Okahandja; Rehoboth; Rietmond; Windhuk. **Angola:** Capangombe,[1] Catumbila; Chitau; Duque de Bragança; Gauca; Humbe; Kahuihui; Kalukembe; Kalundunga; Kuvangu River S. of Vila da Ponte; Maconja; Mossamedes; Mucungu; Quilengu; Quisangue. **Belgian Congo:** Fucafuca, Yellala Falls, Congo River; Kikamero on Ruchuru plains; Manda; Mahagi Port; Monbuttu; Tembwe. **Madagascar:** (many localities).

Range. The typical race ranges outside the rainforest from the Cape to Natal, northwards to Somaliland and the Anglo-Egyptian Sudan where intermediates with the northern race occur over a wide belt from Somaliland through northern Kenya and Uganda to Senegal.

[1] Individuals with pectorals separated occur here also.

Without the continent it occurs in Madagascar, but the Sinai record (Boulenger, 1889a, p. 197) is questioned by Flower (1933, p. 752) who quotes Boulenger as saying that the old entry in the British Museum register on which it was based "may well be erroneous."

Folklore. The odour of the marsh terrapin, according to Kalahari natives, resembles that of a lion and will stampede cattle (FitzSimons, 1935b, p. 307).

Pelomedusa subrufa olivacea (Schweigger)

1814. *Emys olivacea* Schweigger, Prodromi mon. Chelon., p. 38: "In Fabulosis Nigritae" Adanson coll. = Senegal.
1835. *Pentonyx Gehafie* Rüppell, Neue Wirbelth. Fauna Abyss., Amph., p. 2, pl. i: Massaua, Eritrea.
1851. Duméril & Duméril, p. 18.
1852. A. Duméril, p. 245.
1860. A. Duméril, p. 163, pl. xiii, fig. 4.
1922a. Mertens, p. 169.
1844. *Pelomedusa gehafiæ* Gray, p. 38.
1855. Gray, p. 53.
1865. Strauch, p. 113.
1862b. Peters, p. 271.
1870. Blanford, p. 444.
1870. Gray, p. 81.
1871. Sclater, p. 325, fig. (Upper Zambezi)
1873b. Gray, p. 71.
1884a. Rochebrune, p. 22.
1935. Hewitt, p. 325.
1884a. *Pelomedusa Gasconi* Rochebrune, Faune Senegambie, Rept., p. 25, pl. i, figs. 1–2: Dagana, Senegal (restricted). No type preserved.[1]
1910. *Pelomedusa galeata* var. *disjuncta* Vaillant & Grandidier, Hist. phys. nat. pol. Madagascar, **17**, Rept., p. 56, pl. xx, fig. 3. Du Bourg de Bozas coll. = Shore of Lake Abaya, Sidamo, Ethiopia.[1]
1936e. *Pelomedusa galeata gehafie* Parker, p. 609.
1937a. *Pelomedusa subrufa gehafie* Mertens, p. 140.

In addition to the above are many citations listed under the typical form, most of them being indicated by an asterisk before the name.

Names. *Gehafie* (at Massaua); *nguru* (Kitosh); *njaba* (Ganda).

History. As the type of *olivacea* consisted of a carapace, it is pure assumption, based on the fact that *gasconi* of Senegal has the pectorals separated, that the name is employed. The race, apparently the only

[1] Data kindly supplied from Paris Museum catalogue by Mons. Angel, though the specimen could not be located at the moment.

one found in Eritrea, occurs alongside typical *subrufa* at Oda, Ethiopia and Stagno Saha, Italian Somaliland. Individuals with separated pectorals crop up again on Possession Island, South-West Africa; Capangombe, Angola; Zambezi River and Madagascar, being taken with typical *subrufa*. Though a poor race it should be recognised, perhaps, on the grounds that it is pure in Eritrea.

Description. Differs only from the typical form in having the pectoral shields widely separated on the median line of the plastron.

Localities. **Anglo-Egyptian Sudan:** Sennar. **Eritrea:** Anseba River; near Cheren; Lebka River; Massau; Sabarguma. **Ethiopia:** Lake Abaya; Oda. **Italian Somaliland:** Stagno Saha. **Kenya Colony:** Kaliokwell River; Kirui's in Kitosh **Uganda:** Mabira Forest; Mt. Elgon. **Nigeria:** Keana.

While the following are tentatively referred to this race. **French Cameroon:** Bipindi (?det.). **Togoland:** Mangu. **Gold Coast: French West Africa. Senegal:** Dagana; Rufisque (Rochebrune's other localities omitted).

Range. As indicated above, the limits of distribution of the race *olivacea* are still uncertain, it may be regarded as the drier regions of a belt extending from Senegal to Eritrea, intergrading with the typical form in the Anglo-Egyptian Sudan, Ethiopia, Somaliland, northern Kenya and Uganda.

Genus Pelusios

1825. *Sternothaerus* Bell (part), (not *Sternotherus* Gray, 1825, p. 211: type *odoratus*), p. 305.
1830. *Pelusios* Wagler, Nat. Syst. Amphib., p. 137 (type *subniger*).
1863. *Tanoa* Gray, Proc. Zool. Soc. London, p. 193 (type *sinuatus*).
1863. *Notoa* Gray, Proc. Zool. Soc. London, p. 195 (type *castaneus*, *subniger*).

Skull without supratemporal roof; quadrato-jugal widely separated from parietal; upper jaw with very indistinct median ridge on alveolar surface; between the orbits are a pair of supraorbital shields separated by a longitudinal suture and followed by a large frontal flanked by temporals; plastron large, a hinge between hyoplastra and hypoplastra permits closing of front lobe *in adults;* mesoplastral bones extending right across plastron; digits very short, the median with 3 phalanges; feet with 5 claws.

Range. Africa south of the palaearctic zone; Madagascar and islands of the Indian Ocean.

Key to the Species

1. Suture between abdominals included *more* than twice in length of anterior lobe of plastron ..... 2.
   Suture between abdominals included *less* than twice in length of anterior lobe of plastron ..... 3.
2. Crown of head vermiculated; no black vertebral line extending entire length of carapace; suture between humerals 3 to 4 times as long as that between the pectorals ..... *adansonii* (p. 483)
   Crown of head uniform except for a black Y-shaped marking uniting orbits posteriorly with nape; a black vertebral line extends entire length of carapace; suture between humerals 1½ to 2 times as long as that between the pectorals ..... *gabonensis* (p. 485)
3. Plastron entirely black, entirely yellow, or yellow with darker infuscations, the latter not forming a sharply defined angular pattern round the periphery (in some Transvaal and Malagasy terrapin the pattern of *sinuatus* is foreshadowed but not sharply defined); its anterior lobe always longer than the suture between the abdominals; posterior margin of carapace usually rounded; narrowest interorbital width equal to, or slightly longer, or slightly shorter than the suture between the supraorbitals .. *subniger*. (p. 489)
   Plastron yellow (white) broadly edged with black, the latter forming a sharply defined angular pattern round the periphery (sometimes blurred or masked in old individuals with a carapace length of 250 mm. or more); its anterior lobe longer than the suture between the abdominals (equal to or slightly shorter in old specimens); posterior margin of carapace sharply serrate except in very old terrapin; narrowest interorbital width only two-thirds the length of the suture between the supraorbitals .. *sinuatus*[1] (p. 502)

I had fully anticipated that *subniger* would be separable into a number of local forms, but though weeks were spent on this one species I have failed entirely to find any characters of colour or proportions which offer a reasonable prospect of separating alleged races. Apparently striking differences invariably turn out to be those of sex or age, while those of colour, constant in one locality, crop up here and there without obvious geographical significance.

My method was to draw up a detailed description based solely on 34 terrapin from Kaimosi in Kenya, then a similar description based on

[1] The two specimens from Port Natal, referred to *sinuatus* by Boulenger, agree with that species in having the anterior lobe shorter than the suture between the abdominals (they are old, being over 200 mm.), but Mr. Parker informs me that the female's plastron is entirely black, that of the male dark brown with the central area somewhat lighter.

12 specimens from the Seychelles, and so on. When these descriptions were compared no character of consequence could be detected. Such as appeared from the wording, were rechecked by direct comparison of the specimens and usually found to have no significance. Yet the two series cited were readily separable on their respective wholly black or wholly yellow plastrons; but such a colour difference could not be correlated with distributional areas, and so many variants of an intermediate pigmentation crop up here and there that even recognition of an average difference appeared unjustifiable.

I can only hope that enthusiasts for naming local forms will pause to accumulate big series before embarking on the description of further races for which single individuals may offer apparent justification. Comparisons, *except between individuals of the same sex and age,* lead only to confusion.

Pelusios adansonii (Schweigger)

1814. *Emys Adansonii* Schweigger, Prodromi mon. Chelon., p. 39: "Nigritis." *i.e.* Cape Verde, Senegal (*vide* Dum. & Bib., 1835).
1831. *Hydraspis Adansonii* Gray, p. 40.
1835. *Pentonyx Audansonii* (*sic*) Duméril & Bibron, p. 394.
1844. *Pelomedusa? Adansonii* Gray, p. 38.
1851. *Sternothaerus Adansonii* Duméril & Duméril, p. 19.
1855. Gray, p. 52.
1864b. Gray, p. 296, pl. xxiii.
1865. Strauch, p. 109.
1870. Gray, p. 80.
1873b. Gray, p. 70.
1884a. Rochebrune, p. 21.
1889a. Boulenger, p. 196.
1890. Büttikofer, p. 436.
1900. Flower, p. 967.
1903d. Siebenrock, p. 197.
1904. Andersson, p. 9.
1906a. Siebenrock, p. 826.
1908. Werner (1907), p. 1826.
1909. Siebenrock, p. 560.
1910. Müller, p. 623.
1912b. Werner, in Brehm, p. 470.
1917. Sternfeld, p. 414.
1919. Schmidt, p. 600.
1924a. Werner, p. 268.
1925b. Flower, p. 933.
1934a. *Pelusios adansoni* Mertens, p. 10.

Names. Adanson's Terrapin.

Illustrations. Gray (1864b, pl. xxiii) furnishes a drawing of the upper aspect of this terrapin in life.

History. The type is in the Paris Museum. Bocage (1867a, p. 217) recorded *adansonii* from Angola, later correcting his identification to *derbianus*, now a synonym of *subniger*.

Description. Head broad, snout short; a pair of supraorbital shields followed by a very large frontal, flanked by a pair of temporals; narrowest interorbital width equals the longitudinal suture between the supraorbitals; upper jaw neither hooked nor bicuspid; chin with a pair of elongate barbels; scales on anterior aspect of fore limb irregular in size; carapace moderately depressed, its height included in its length about 2.64 times, broadening posteriorly, its posterior margin rounded; vertebral shields 5, the anterior 4 keeled *throughout life*[1], broader than long in young, nearly as long as broad in adult, first and fifth subequal in length and breadth, as broad (at their broadest) as long; costals 4 pairs; marginals 22; supracaudals 2; plastron considerably smaller than the opening of the carapace; anterior lobe somewhat rounded, not or but slightly projecting beyond the carapace; posterior lobe angularly and deeply notched; intergular 1½ to 2 times as long as a gular, 2 times as long as broad, its sides wedge-shaped; humerals forming a suture 3 to 4 times as long as that of the pectorals, outer border of a humeral equal to, or shorter than, that of a pectoral; pectorals *not* excluded from bridge by abdominals; width of bridge contained 2 (young) times in the width of the plastron; suture between abdominals less than half the length of the anterior lobe of plastron.

This description is based on a Shari River juvenile in the Museum of Comparative Zoölogy, together with descriptions in the literature.

Anatomy. An abnormal Sennar shell in which the anterior costal bones are in contact, thus separating nuchal and first neural, has been described by Werner (1924a, p. 268).

Coloration. Above, head yellow vermiculated with brown; carapace yellowish to pale brown with radiating brown lines and dots. Below, labial region, plastron, and all lower parts yellowish.

Werner (1924a, p. 268), however, reports on a 160 mm. male from Tonga as being shining black both above and below except along the sutures of the plastron which are white and worn.

Measurement. Length of carapace of a Sennar specimen 185 mm., breadth 125 mm. (Werner, 1924a, p. 268).

[1] *fide* Boulenger.

Breeding. In March, at Tonga, White Nile, 7 eggs measuring 29.5 x 18 and 33 x 19 mm., were found in a ♀ by Werner (1924a, p. 268).

Longevity. 9 years, 8 months, and still alive at Giza Zoological Gardens (Flower, 1925b, p. 933).

Habitat. Rivers outside the rainforest. Siebenrock (1906a, p. 826) remarks on the fact that this species ranges to the edge of the palaearctic region and is thus the most northerly member of its genus. His suggestion that the deserts of Darfur and Kordofan have interrupted its distribution is unlikely, the answer is more probably to be found in the very little collecting which has been done in this area.

Localities. **Anglo-Egyptian Sudan:** Bahr el Gebel near Mongalla; Bahr el Ghazal; Bahr el Zeraf; Gondokoro; Khor Attar; Sennar; Tonga; White Nile south of Abu Zeit. **French Cameroon:** Guffei on Shari River; Tara on Isade River. **Senegal:** Cape Verde. **Liberia.**

Range. Senegal east to the White Nile (from Abu Zeit south to Gondokoro), Anglo-Egyptian Sudan. Reported from Liberia.

Pelusios gabonensis (A. Duméril)

1856. *Pentonyx Gabonensis* A. Duméril, Rev. Mag. Zool., **8**, p. 373: Gabon.
1860. A. Duméril, p. 164, pl. xiii, figs. 2, 2a.
1864a. Gray, p. 168.
1874. Reichenow, p. 298.
1862. *Pelomedusa gabonensis* Strauch, p. 45.
1865. Strauch, pp. 107, 113.
1864. *Pelomedusa gabonica* Peters, p. 644.
1873a. *Sternothaerus sp.* Gray, p. 393, fig.
1873b. *Sternothaerus derbianus* Gray (part), p. 69.
1876a. Peters, p. 117.
1875a. *Sternothaerus niger* Peters (not of Duméril & Bibron), p. 196.
1889a. Boulenger, p. 194, fig. 46.
1890. Büttikofer, p. 478.
1893c. Matschie, p. 208.
1897. Sjöstedt, p. 33.
1898. Werner, p. 204.
1902c. Tornier, p. 665.
1903d. Siebenrock, p. 191.
1905a. Siebenrock, p. 461.
1906. Johnston, pp. 820, 833.
1906a. Mocquard, p. 480.
1909. Siebenrock, p. 555.
1910. Müller, p. 622.
1910b. Nieden, p. 7 (text apparently transposed with that of *galeata*)

1911. Lampe, p. 148.
1925b. Flower, p. 932.
1889a. *Sternothaerus gabonensis* Boulenger, p. 197.
1897. Sjöstedt, p. 33.
1898. Werner, p. 204.
1900b. Boulenger, p. 447.
1901. Siebenrock, p. 7.
1902c. Tornier, p. 665.
1903d. Siebenrock, p. 197.
1905a. Siebenrock, p. 461.
1906a. Mocquard, p. 480.
1907. Siebenrock, p. 6.
1909. Siebenrock, p. 560.
1916. Siebenrock, p. 10, pl. i, fig. 1, pl. ii, fig. 4.
1919g. Boulenger, p. 12.
1933m. Witte, p. 67.
1901. *Sternothaerus Steindachneri* Siebenrock, Zool. Anz., **25**, p. 6: "Madagascar" Bought from a dealer.
1919. *Pelusios gabonensis* Schmidt, pp. 413, 598, fig. 1.
1934a. Mertens, p. 10.
1937c. Loveridge, p. 269.
1919. *Pelusios niger* Schmidt (not of Duméril & Bibron), pp. 598, 600.
1934a. Mertens, p. 10.
1934. Müller, p. 166.
1937a. Flower, p. 14.
1938b. Mertens, p. 33.
1924. *Sternothaerus heinrothi* Kanberg, Zool. Anz., **60**, p. 195, fig.: Cameroon.
1926. Kanberg, p. 225.

Erroneous records of *gabonensis* (Bocage, 1866a, 1866b, and Rochebrune, 1884a) will be found under *subniger*.

Names. Gaboon Terrapin.

Illustrations. Siebenrock (1916, pls. i-ii) furnishes excellent black and white figures of an adult from above and below; Duméril's (1860, pl. xiii) figures of the juvenile type do not show its distinguishing characteristics; Schmidt (1919, fig. 1) an outline drawing of a juvenile from below, nobody has figured the handsome young or middle-aged stage with its black vertebral line on a yellowish brown carapace.

History. The tangled synonymy of this species may be said to have commenced when Gray (1873a, p. 393) wrote "we have fortunately discovered a very large skull, evidently belonging to the genus *Sternothaerus*, which M. du Chaillu had used (as he did the new species of

Bush-buck which I described . . .) to stuff out the skin of a large African mammal." Later in the year Gray referred this skull to *derbianus* (which I regard as a synonym of *subniger*). Because it agreed with Duméril & Bibron's description of *niger* (1835), however, Boulenger (1889a, p. 194) identified and figured it as that species.

The pertinent portion of the description "museau allongé; machoire supérieure se recourbant en bec crochu;" is rather one of age in members of this family. It is particularly pronounced in Du Chaillu's specimen, obviously from an aged animal, as Gray states that it measured 2 1/6 inches from cheek to cheek, 2 1/2 inches from nose to condyle. The largest *gabonensis* in the Museum of Comparative Zoölogy, an alcoholic with a carapace length of 245 mm., has a head measuring 2 inches from cheek to cheek, its skull length cannot be measured.

Since Boulenger, there has been a tendency to refer all old black Cameroon terrapin to *niger*, all half-grown or young with characteristic vertebral stripe to *gabonensis* though the evolution of colouring of the carapace is clearly seen in a good series of all ages. Siebenrock even invokes the age character of colour as being the only reliable means of separating *gabonensis* from what he calls *niger, i. e.* the black throat and underparts of the young which become dirty yellow in older reptiles.

I reject *niger* as being applicable to the West African *gabonensis*, not only because Duméril & Bibron thought that it came from Madagascar, which may have been the case, but because they state that the top of the head in *niger* is marbled with brown on a fawn ground, and the jaws are horn coloured with vertical rays of a maroon tint. This is the coloring of *subniger*, not of *gabonensis*, which has a black Y-shaped marking on the occiput and the jaws uniformly coloured.

Siebenrock (1903d, p. 197) himself referred *steindachneri* to the synonymy of *gabonensis* after examining the type of the latter in the Paris Museum.

Müller (1934, p. 166) produced overwhelming proof for placing *heinrothi* in the synonymy of "*niger*," by which he meant *gabonensis* as here understood.

Description. Head broad, snout only moderately short, acuminate; a pair of supraorbital shields followed by a very large frontal, flanked by a pair of temporals; narrowest interorbital width equals or is shorter than the longitudinal suture between the supraorbitals; upper jaw angularly rounded in young, slightly notched and bicuspid in adults, hooked in very old specimens; chin with a pair of barbels which are

long in young and short in adults; scales on anterior aspect of fore limb irregular in size; carapace depressed, its height included in its length 2 34 to 3.76 times, elongate, its posterior margin rounded, not or but slightly serrate even in young; vertebral shields 5, all keeled in young, the rather nodose keels of the posterior 3 persisting except in very old individuals, all 5 broader than long in young *and* adults though occasionally the fourth and fifth may be longer than broad in adults; costals 4 pairs; marginals 22; supracaudals 2; plastron much smaller than the opening of the carapace; anterior lobe rounded or intergular slightly projecting, usually not, though occasionally slightly projecting beyond the carapace; posterior lobe more or less angularly and deeply notched; intergular normally 2, rarely 3, times as long as a gular, 1⅓ to 1½ times as long as broad, its sides straight, wedge-shaped, or pyriform; humerals forming a suture 1½ to 2 times as long as that of the pectorals outer border of a humeral longer than, rarely equal to, that of a pectoral; pectorals *not* quite excluded from bridge by abdominals; width of bridge contained 1½ (adults) to 2 (young) times in the width of the plastron; suture between abdominals included 2¼ to 3½ times in the length of the anterior lobe of plastron.

Anatomy. The skull of an old terrapin has been figured and described at length by Gray (1873a, p. 393).

Coloration. Above, head yellow brown, a broad black Y-shaped marking connects the eyes and extends backwards on the nape, another stripe between eye and tympanum is sometimes present; limbs black in young, drab buff or greyish yellow in adults; carapace yellow brown in young darkening with age through the appearance of dark radial lines on the discoidal shields till *almost* black in old individuals, a black vertebral streak, broadening anteriorly on the suture between the anterior marginals, extends to the supracaudal suture, this characteristic marking is less conspicuous in very old terrapin but can be found if sought. Below, jaws and throat *uniform* horn colour except in young when the throat is black; plastron uniform black or with the sutures between the shields narrowly edged with yellow; occasionally plastron yellowish brown, each shield so heavily overlaid with radiating black markings as to appear mostly black, carapace light yellow, each marginal blotched with black, particularly in the region of the bridge.

Measurements. Length of carapace of a ♂ from Edea, 270 mm., breadth 167 mm., height 88 mm. (Müller, 1910). Length of carapace of a ♀ from Isongo, 258 mm. (Mertens, 1938b).

Sexual dimorphism. Males, recognizable by their longer tails, ex-

hibit a slight depression in the posterior third of the plastron, which is flat in females.

Longevity. 7 years, 4 months, 20 days (Flower, 1937a, p. 14) is surpassed by one stated to be 10 years and still alive by Müller (1934, p. 166).

Diet. In captivity, water insects, ant pupae, worms, snails, fish and raw beef should be furnished *in variety, particularly for young,* at temperature of 18° to 20° C.

Parasites. Leeches were about the hind limbs of a terrapin taken from the Lepoko River (Lang, in Schmidt, 1919, p. 414).

Enemies. Eaten by the Congolese (Lang, in Schmidt, 1919, p. 414).

Habitat. Young and half grown are to be found in swampy places and smaller streams, but large examples must be sought for in the rivers of the rainforest belt, where they are frequently drowned in fish traps (Lang, in Schmidt, 1919, p. 414).

Localities. **Cabinda. Belgian Congo:** Akenge; Avakubi; Buta; Djamba; Gamangui; Ituri River west of Ruwenzori Mountains; Medje; Nepoko River; Niapu; Nyonga; Pawa; Poko; Saidi's Village on Avakubi-Irumu road; Stanleyville. **French Congo:** Gaboon. **French Equatorial Africa:** Nola. **Spanish Guinea. French Cameroon:** Ebolowa; Isongo; Jaunde; Kribi; Metet; Sakbayeme; Sanaga River near Edea; Sangmelina. **Nigeria:** Benin. **Gold Coast:** Akusi. **Liberia** (thrice reported, but without locality.)

Range. West Africa from Liberia south to Cabinda, eastwards through the Belgian Congo to the Ituri River.

Pelusios subniger (Lacépède)

1788. *La Noiratre* Lacépède, Hist. nat. Quadrup. ovip. Serpens, **1**, p. 175. pl. xiii: No locality.
1789. *Testudo subnigra* Lacépède, Hist. nat. Quadrup. ovip. Serpens, **2**, Synopsis methodica (a table in which binomials are employed).
1789. Bonnaterre, p. 30, fig. 6.
1802. Daudin, p. 197.
1798. *Testudo Nigricans* Donndorff, Zool. Beytr. Linn. Natur., **3**, p. 34: No locality.
1814. *Emys castanea* Schweigger, Prodromi mon. Chelon., p. 45: No locality.
1814. *Emys subnigra* Schweigger, p. 46.
1820. *Terrapene nigricans* Merrem, p. 28.
1825. *Kinosternon nigricans* Bell, p. 305.
1825. *Sternothaerus Leachianus* Bell, Zool. Journ., **2**, p. 306: No locality.
1831. *Sternotherus subniger* Gray, p. 38.

1844. Gray, p. 37.
1855. Gray, p. 51.
1863b. Gray, p. 195, fig.
1864b. Gray, p. 168, fig.
1870. Gray, p. 79.
1873b. Gray, p. 70.
1831. [1]*Sternotherus castaneus* Gray, p. 38.
1835. Duméril & Bibron, p. 401.
1865. Strauch, p. 108.
1866b. Peters, p. 887.
1869a. Peters, p. 12.
1878a. Peters, p. 202.
1880b. Peters, p. 509.
1880b. Vaillant, p. 797.
1881c. Boettger, p. 535.
1884a. Rochebrune, p. 19.
1891. Vaillant, p. 94.
1910. Vaillant & Grandidier, pp. 26, 58, pls. xviii-xix.
1931d. Angel, p. 550.
1835. *Sternotherus Niger* Duméril & Bibron, p. 397.
1835. *Sternotherus Nigricans* Duméril & Bibron, p. 399.
1848. Peters, p. 494, pl. xvii, fig. 6.
1862. Strauch, p. 148.
1865. Strauch, p. 108.
1867a. Steindachner, p. 6.
1877b. Peters, p. 455.
1882a. Peters, p. 8.
1884a. Rochebrune, p. 19.
1889. Boettger, p. 297.
1889a. Boulenger, p. 195.
1891. Vaillant, p. 94.
1893a. Boettger, p. 13.
1893b. Stejneger, p. 713.
1895. Rathgen, p. 200.
1896a. Bocage, p. 97.
1896. Tornier, p. 4.
1897. Tornier, p. 63.
1898. Tornier, p. 282, fig. 2.
1898a. Vaillant, p. 133.
1900b. Tornier (part), p. 582.
1903a. Siebenrock, p. 254.
1903d. Siebenrock, p. 195.
1907a. Boulenger, p. 6.

[1] The spelling *Sternothaerus* has not been separated for separate headings.

1907j. Boulenger, p. 482.
1908. Chubb, p. 220.
1908. Rembold, p. 743, figs. 2–3.
1909h. Boulenger, p. 295.
1909a. Chubb, p. 592.
1909b. Chubb, p. 34.
1910a. Andersson, p. 11.
1911b. Masi, p. 132.
1911. Sternfeld & Nieden, p. 385.
1912c. Sternfeld, p. 201.
1912b. Werner, p. 469.
1913c. Nieden, p. 59.
1916. Siebenrock, p. 6, pl. i, fig. 2, pl. ii, fig. 5.
1923g. Loveridge (part), pp. 930, 932.
1924b. Loveridge, p. 2.
1925b. Flower, p. 933.
1928. Cott, p. 952.
1931. Monard, p. 109.
1933m. Witte, p. 67.
1937b. Monard, pp. 146, 148.
1939a. Rendahl, pp. 304, 322, figs. 11–12.
1844. *Sternotherus Derbianus* Gray, Cat. Tortoises Brit. Mus., p. 37: Gambia (restricted).
1855. Gray, p. 52, pl. xxii.
1863b. Gray, p. 194.
1864a. Gray, p. 167.
1865. Strauch, p. 109.
1866a. Bocage, p. 41.
1866b. Bocage, p. 57.
1867a. Bocage, p. 218.
1870. Gray (part), p. 79.
1873b. Gray (part), p. 69.
1877c. Peters, p. 611.
1881b. Boettger, p. 409.
1884. Greeff, p. 48.
1884a. Rochebrune, p. 20.
1886a. Bocage, p. 66.
1888a. Boettger, p. 15.
1889a. Boulenger, p. 195.
1889. Hesse, p. 262.
1890. Büttikofer, pp. 436, 478.
1890a. Müller, p. 296.
1890. Strauch, p. 102.
1892c. Bocage, p. 230.
1893a. Boettger, p. 13.

1893c. Matschie, p. 208.
1895a. Bocage, p. 3.
1896a. Bocage, p. 74.
1897. Sjöstedt, p. 7.
1898. Jeude, p. 9.
1898. Werner, p. 204.
1900b. Boulenger, p. 447.
1901. Gadow, p. 391.
1901c. Tornier, p. 67.
1902c. Tornier, p. 665.
1903d. Siebenrock, p. 196.
1905. Bocage, p. 90.
1906i. Boulenger, p. 197.
1906. Johnston, pp. 820, 833.
1906a. Mocquard, p. 480.
1907. Johnson, pp. 14, 69, photo.
1908. Rembold, p. 742, fig. 1.
1909. Siebenrock, p. 559.
1911c. Boulenger, p. 162.
1911. Lampe, p. 148.
1912b. Werner, p. 470.
1919g. Boulenger, p. 12.
1919. Schmidt, pp. 598, 600.
1921a. Chabanaud, p. 461.
1921b. Chabanaud, p. 522.
1923g. Loveridge, p. 932.
1924b. Loveridge, p. 2.
1925b. Flower, p. 933.
1928. Cott, p. 952.
1930b. Witte, p. 84.
1933. Schmidt, p. 3.
1933m. Witte, p. 67.
1934a. Mertens, p. 10.
1936. Frade, p. 67, pls. vii-viii.
1937. Andersson, p. 2.
1851? *Sternotherus nigricans* ? var. Bianconi, p. 58, *nigrescens*, pl. vii. (a misprint as *Sthernotherus nigrescens* Dum. Bib. also given).
1866a. *Sternothaerus gabonensis* Bocage (*non* Duméril), p. 40.
1866b. Bocage, p. 57.
1884a. Rochebrune, p. 23.
1867a. *Sternothaerus Adansoni* Bocage (*non* Schweigger), p. 217.
1881c. *Sternothaerus subniger* Boettger, p. 535.
1910. Vaillant & Grandidier, p. 26, pls. xviii-xix.
1884a. *Sternothaerus niger* Rochebrune (*non* Duméril & Bibron), p. 19.
1884a. *Sternothaerus sinuatus* Rochebrune (*non* Smith), p. 20.

1889. Boettger, pp. 296–7.
1889a. Boulenger (part), p. 194.
1893a. Boettger, p. 13.
1895a. Bocage, p. 4.
1896. Tornier (part), p. 4.
1902d. Boulenger, p. 445.
1909b. Boulenger, p. 302.
1909h. Boulenger, p. 295.
1910. Roux, p. 100. (photographs of specimen seen).
1911. Lampe, p. 148.
1912c. Sternfeld (part), p. 200.
1937b. Monard, pp. 146, 148.
1885d. *Sternothaerus sp.* Müller, p. 716.
1909. Gendre, 1909, p. cvi.
1897f. *Sternothaerus oxyrhinus* Boulenger, Proc. Zool. Soc. London, p. 919, pl. liii: No locality. (Based on live specimen in zoo.)
1906b. *Sternothaerus nigricans castaneus* Siebenrock, p. 35, pl. v, fig. 18.
1909. Siebenrock, p. 557.
1913. Boettger, pp. 318, 352.
1915. Rawitz, p. 658, pl. xlviii, figs. 62–67.
1918. Barbour, p. 489.
1922. Kaudern, p. 449, fig. D.
1906b. *Sternothaerus nigricans nigricans* Siebenrock, pp. 36, 40, pl. v, fig. 19.
1909. Siebenrock, p. 558.
1913. Boettger, p. 319.
1915. Rawitz, p. 663.
1922. Kaudern, p. 449.
1939b. Rendahl, p. 3.
1906b. *Sternothaerus nigricans seychellensis* Siebenrock in Voeltzkow, Reise in Ostafrika in den Jahren 1903–1905, **2**, p. 38: Gloriosa Island, Seychelles.
1909. Siebenrock, p. 558.
1912c. *Pelomedusa galeata* Sternfeld (part), p. 201.
1919. *Pelusios nigricans* Schmidt, pp. 411, 460, fig. 1, pl. xi, fig. 3.
1928c. Barbour & Loveridge, p. 104.
1934. Pitman, p. 307.
1927a. *Pelusios nigricans nigricans* Hewitt, p. 375.
1933h. Loveridge, p. 209.
1936j. Loveridge, p. 223.
1937c. Loveridge, p. 269.
1937f. Loveridge, pp. 489, 492, 495.
1927a. *Pelusios nigricans castaneus* Hewitt, p. 375.
1928d. Loveridge, p. 51.
1935. Hewitt, p. 344.

1927a. *Pelusios nigricans rhodesianus* Hewitt, Rec. Albany Mus., p. 375, figs., 1a, 1c, pl. xxvi, figs. 2–3: Mpika district, N. Rhodesia.
1933h. Loveridge, p. 210.
1934. Pitman, p. 307.
1929. *Pelusios subniger* Lindholm, p. 288.
1931. *Pelusios nigricans castanoides* Hewitt, Ann. Natal Mus., **6**, p. 463, pl. xxxvi, figs. 1–2: Richard's Bay, Zululand.
1932. *Pelusios bechuanicus* FitzSimons, Ann. Transvaal Mus., **15**, p. 37: Thamalakane River at Maun, Ngamiland, Bechuanaland Protectorate.
1934a. Mertens, p. 10.
1935b. FitzSimons, p. 306, pl. xi.
1933b. *Pelusios subniger subniger* Mertens, p. 263.
1934a. Mertens, p. 10.
1933b. *Pelusios subniger castaneus* Mertens, p. 263.
1934a. Mertens, p. 10.
1933. *Pelusios sinuatus sinuatus* Schmidt (not Smith), p. 3.
1934a. *Pelusios subniger castanoides* Mertens, p. 10.
1934a. *Pelusios subniger rhodesianus* Mertens, p. 10.
1934a. *Pelusios subniger seychellensis* Mertens, p. 10.
1935. *Pelusios rhodesianus* Hewitt, p. 345.
1937b. *Pelusios derbianus* Angel, p. 1696.
1937a. Flower, pp. 14, 36.
1937f. Loveridge, pp. 489, 503.
1938e. Mertens, p. 430.
1939a. *Sternothaerus castaneus seychellensis* Rendahl, pp. 308, 322, figs. 13–14.
1939b. Rendahl, p. 3.

Erroneous records of *castaneus* (Gray, 1831, 1844) and *nigricans* (Loveridge, part, 1923g, 1928d) will be found under *sinuatus*, and *derbianus* (Gray, 1873b; Peters, 1876a) under *gabonensis*.

Names. Black Terrapin (English); *lihodu* (Tereki); *likudu* (Ragoli); *kikui* (Kami); *malfudi* (Gogo); *kajamba* (Nyakusa). In Angola *kantuva* (at Osi); *ombco* (at Bimbi); *otyiti* (at Elende); *tyitunda* (at Kuvangu). Malagasy names are not included.

Illustrations. Good photographs of living terrapin are furnished by Johnson (1907, p. 14) and Schmidt (1919, pl. xi), while most of the more recent figures cited in the synonymy illustrate some form of this variable reptile.

History. Vaillant (1891, p. 94) claims to be able to distinguish *castaneus* in West Madagascar by a fine silver line encircling the pupil, while *subniger* (or *nigricans*) of East Madagascar is said to have a uniform brown iris, the difference is supported by other characters of minor

importance. This alleged distinction appeared to me to be a sexual one, an idea which later received support from the plates supplied by Vaillant and Grandidier (1910) which show a ♂ shell as *castaneus*, a ♀ as *subniger*. The point requires checking in the field, but the more rounded shell of the female appears to have misled several workers into supposing that they were dealing with two forms. Rawitz's (1915, p. 582) statement that he noticed differences in spinal structure between Eastern and Western Malagasy specimens should also be investigated.

Mertens (1933b, p. 263) repeats the other characteristics as typifying a West Madagascar race, and they are certainly present in our solitary West Madagascar specimen but also in a Zanzibar and occasional mainland individuals. As the row of large polygonal shields anterior to the barbels may be present or absent in mainland terrapin, I do not attribute specific importance to them.

Siebenrock (1903d, p. 196) failed to find any constant characters by which *derbianus* might be separated, though he proposed retaining the name in the hope that some average difference might be found, remarking that apparently most herpetologists used the name on geographic, rather than taxonomic, grounds. Both black and yellow-brown terrapin are represented in a series from Portuguese Guinea and similar colour differences have been reported from other West African material. Our topotypic Gambia terrapin can be matched by individuals of the same age and sex from the East so I cannot see any possibility of regarding *derbianus* as separable even in a subspecific sense.

The type of *oxyrhinus* arrived at the zoo with a shipment containing *adansonii*. In describing it, Boulenger stated that *derbianus* was its closest relative but it might be distinguished on its more acuminate snout. On this account Siebenrock (1903d, p. 192) synonymized it with "*niger*", by which he meant *gabonensis* as here understood. This action was incorrect as the vermiculate head markings are those of the *subniger* group and cannot be confounded with the distinctive black Y-shaped marking on the otherwise uniform crown of *gabonensis*.

S. n. seychellensis was long ago synonymized by Boulenger (1909h, p. 295) and in detail by Nieden (1913c, p. 60). As I entertained expectations that it would prove a valid race, I induced Mr. Vesey Fitz-Gerald to send me a dozen specimens from the Seychelles. After drawing up a detailed description based solely on this material, I compared it with a similar description founded only on the thirty-four Kaimosi, Kenya Colony, terrapin. The only significant difference, apart from an average colour, was the better bicuspid development of the upper

jaw, which appears to be constant in the Seychelles, highly variable on the mainland. More recently, Rendahl (1939a, p. 308), with half-a-dozen Seychelle specimens, has revived *seychellensis* but as a race of *castaneus!* He claims that both *nigricans* and *c. seychellensis* occur on La Digue Id., and gives (p. 313) fourteen characters which allegedly separate the two. I have carefully tested these with our Seychelle material and find that Nos. 1, 3, 7 and 8 are individual variations, 11 is an age character, the rest are sexual, usually, though not invariably constant. What he has done is to separate the sexes.

In describing *P. n. rhodesianus* from Mpika district, Hewitt (1927a, p. 375) remarked that he had also a series of fairly typical *nigricans* from the same district as well as from Kenya Colony. Later, finding *rhodesianus* at Entebbe where it occurs alongside typical *subniger* (inc. *nigricans*) he thought it better to raise *rhodesianus* to specific rank. Actually it is founded on an inconstant character — the shape of the intergular — which does not remain constant as Hewitt had hoped.

P. n. castanoides of Zululand, based on a very old 325 mm. terrapin, was considered to differ in the absence of barbels. The state of development of these barbels varies considerably and though I have found no specimens in which they could not be detected, I suggest that in *castanoides* they are probably absent as an individual variation, possibly some injury to the derm in youth? FitzSimons (1935b, p. 307) found them present and absent in specimens of *Pelomedusa subrufa* in the Kalahari.

P. bechuanicus, founded on a single young 107.5 mm. terrapin, resembles *subniger* in its uniform dark brown plastron and posteriorly rounded carapace, but *sinuatus* in the strongly developed protuberances on the vertebral shields. There are, however, individuals of approximately the same size in our Kaimosi series which match this unusual development, though the majority in the series are typically *subniger* in this respect. Being so young, one would have expected the vertebral shields to be broader than long, as indeed they seem to be in the photographs; in description and diagnosis, however, they are said to be longer than broad.

Description. Head broad, snout short; a pair of supraorbital shields followed by a very large frontal, flanked by a pair of temporals (rarely subdivided), often with a wedge-shaped group of small shields inserted posteriorly between frontal and temporal, occasionally even separating them; narrowest interorbital width equal to, or slightly longer, or slightly shorter[1] than the longitudinal suture between the supraorbital

[1] Ethiopia, Tanganyika, N. Rhodesia, Transvaal, Madagascar, Mauritius, Zanzibar and Seychelles, but with exceptions.

shields; upper jaw angularly rounded, not definitely bicuspid[1] but sometimes indicated with a more or less prominent vertical groove anteriorly; chin with a pair of small barbels [2]; scales on anterior aspect of fore limb irregular in size; carapace moderately depressed, its height included in its length 2.17 to 3.30 times, elongate in males, roundish in females, its posterior margin rounded, not or but slightly serrate in young; vertebral shields 5, the middle 3[3] obtusely (rarely quite strongly with protuberances) keeled, usually [4] much broader than long in young and as long as, or longer than, broad in adults, first and fifth very variable but at their widest usually as broad as, or broader than long; costals 4, rarely 5[5], pairs; marginals 22, rarely 20; supracaudals 2; plastron smaller than the opening of the carapace in males, considerably smaller in females; anterior lobe rounded or intergular slightly projecting, not (males) or very distinctly (females) projecting beyond the carapace; posterior lobe angularly and deeply notched (with a *tendency* to be more acutely in males, more widely in females), the points upturned, recurved, or horizontal; intergular 1½ to 4 times as long as a gular, 1⅛ to 3 times as long as broad, its sides straight, wedge-shaped, converging anteriorly or pyriform; humerals forming a suture 1 to 5 times (averaging 2 for fifty terrapin) as long as that of the pectorals; outer border of a humeral normally much longer, occasionally equal to, or much shorter than that of a pectoral; pectorals excluded from bridge by abdominals; width of bridge contained 1½ to 2 times in the width of plastron, suture between abdominals shorter than (i.e. included 1¼ to 1¾ times) the length of the anterior lobe of the plastron.

The above description is based on all the *subniger* material in the Museum of Comparative Zoölogy, while variations in the literature are for the most part included as footnotes.

A deformed individual from Dakar is described in detail by Strauch (1890, p. 102).

Anatomy. Tornier (1896, p. 9) presents a diagram to illustrate the changes in the outline of a carapace which accompany growth, it should be accepted with reserve owing to his confusing *sinuatus* with *subniger*. Vaillant (1880b, p. 797) comments on the vertebral column. Frade (1936, p. 67) on the epithelial tissue, etc. Rawitz (1915, pp. 658, 663) deals with the nervous system, and Peters (1848, p. 494) with the musk gland.

[1] See Tornier (1900b, p. 582) on variability in single terrapin.

[2] Absent in type of *castanoides fide* Hewitt. See comments above.

[3] These 3 broken up into 5 in a Malagasy terrapin (Anderson, 1910a, p. 11).

[4] Exception a Chitau, Angola, juvenile and types of *bechuanicus*.

[5] Mus. Comp. Zoöl. Nos. 7869, 40031.

Coloration. Above, head yellowish or greenish gray vermiculated with brown or black, the latter sometimes predominating to produce a uniformly dark head; limbs drab or yellowish brown; tail (according to Boettger, 1888a) yellow above with a blackish median line in males; carapace in young, black, or yellowish with brown areolae which spread till carapace becomes dark brown, often leaving light brown coloured areas along the periphery, or black in adults. Below, jaws horn colour with vertical striae of brown or black; plastron horn colour or yellowish with brown or black infuscations which in Transvaal and Malagasy terrapin simulate the more definite angular markings of *sinuatus*, but usually are irregular, penetrating along the sutures between the shields, in some areas the plastron is entirely black, or black with the sutures between the shields white. In Natal (*fide* Strauch) and West Madagascar (Siebenrock and M.C.Z. specimen) the entire reptile may be stained reddish, due, it is said, to laterite soil.

Boulenger (1889a, p. 195), with only Madagascar material, writes of *nigricans* "upper surface of head without spots or vermiculations." Malagasy specimens in the Museum of Comparative Zoölogy exhibit vermiculations though these are greatly reduced in one example.

Perhaps it might be helpful to list our material on the basis of plastral coloration, allocating them into three groups though in some cases with difficulty.

Plastron wholly black, or the sutures white or horn colour. Ex. Kaimosi; Yala River; Entebbe and Ukerewe Id., Lake Victoria; Nyamkole, Lake Tanganyika; Mwaya, Lake Nyasa; Dodoma (though those from this last locality and from Ukerewe Id. appear to have lost most of the black through friction and polishing by sand).

Plastron yellow in centre, infuscated with brown on the margins. Ex. Gambia River; or the brown forming a rather definite pattern as figured by Duméril & Bibron for *castaneus* (pl. xx). Ex. Ethiopia; Transvaal; Madagascar.

Plastron wholly yellow, or almost so. Ex. Butiaba, Lake Albert; Pemba Id.; Zanzibar Id.; Seychelle Ids.

Measurements. Length of carapace of a ♂ from Faradje, 290 mm., breadth 185 mm., height 92 mm. Length of carapace of a ♀ from Faradje, 250 mm., breadth 177 mm., height 106 mm. (Schmidt, 1919, p. 412).

More than once I have been inclined to postulate a small race, as for example at Dodoma where the largest of fifty terrapin brought in by natives, measured only 175 mm. It is wiser to bear in mind, however, the relative rarity and greater difficulty in capturing the largest

terrapin. Looking over the maximum carapace lengths recorded in the literature I am inclined to think that the species attains its greatest dimensions in the region of the Great Lakes and is slightly smaller as one proceeds East and West. A trans-African series of records follow.

San Thomé, 170 mm. (Greef); Gambia, 176 mm. (M.C.Z.); Angola, 250 mm. (Monard); Belgian Congo, 290 mm. (Schmidt) and 280 mm. in s.e. Lake Albert (Sternfeld); Uganda, 241 mm. (Hewitt); Kenya Colony, 257 mm. (Loveridge); Tanganyika Territory, 235 mm. (Loveridge); Northern Rhodesia, 218 mm. (Hewitt); Zululand, 225 mm. (Hewitt); Madagascar, 220 mm. (Siebenrock); Seychelles, 168 mm. (M.C.Z.)

If Lang (in Schmidt, 1919, p. 412) is correct in saying that this species attains a length of 380 mm. (15 inches), which I am inclined to doubt, it is very little smaller than *sinuatus*, long considered the largest representative of the genus.

Sexual dimorphism. The measurements of male and female, furnished above, give a very fair idea of the difference in proportion of the sexes. The carapace tends to be parallel-sided in males, much more rounded as well as arched (to accommodate the eggs) in females, consequently the plastron appears broader posteriorly in males in its relation to the carapace, than is the case in females, it may be slightly concave in males though I am by no means certain that this is always the case as some flat-plastroned terrapin appear to be males; the notch in the posterior lobe may be more acute in males, more obtuse in females (to aid oviposition?) but this appears to be questionable, if an average difference. The tail of a male is longer, but is so short that without comparative material of the opposite sex it would not be recognised.

Boettger's (1888a, p. 15) alleged colour distinctions do not appear to be valid, though it may be anticipated that sexual difference in the colouration of the soft parts in life will be demonstrable. In this connection see the remarks on page 494 under the heading *History*, where it is suggested that the fine silver line encircling the pupil indicates a male, its absence a female; a point worth investigating.

Breeding. The only account of the oviposition of this species which I have come across, is that of Kaudern (1922, p. 449, fig. D), who surprised a female at the edge of a desiccating pond at St. Marie de Marovoay, Madagascar. He alleges that she excavated a flask-shaped hole *with her front legs and head*[1], deposited a dozen eggs in it in the

[1] Almost certainly a mistake.

course of an hour, then filled in the hole. Kaudern secured both the terrapin and her eggs. It would be interesting to know her measurements.

On March 1, at Kaimosi, Kenya Colony, a young terrapin with abdominal shields still unhealed in the umbilical region, and carapace length of 30 mm., was presumed to have hatched very recently.

Growth. In captivity, a young "*nigricans*" from Madagascar grew from 88 to 100 mm. in four years, during the same period a young "*derbianus*" from West Africa grew from 78 to 92 mm.: they shared the same aquarium (Rembold, 1908, p. 743).

Longevity. For "*derbianus*" 40 years, 8 months, 13 days (Flower, 1937a, p. 14); for "*nigricans*" 9 years, 2 months, 11 days (Flower, 1925b, p. 933).

Diet. Grass and claws of crabs (*Potamon* sp.) in faeces at Kaimosi (Loveridge). In captivity earthworms, mealworms, snails, fish, frogs, and raw meat (Rembold, 1908, p. 743).

Enemies. Frequently taken in fish traps at Faradje, Dungu River (Lang). Two terrapin, one having had a piece taken out of its side, appeared to have been bitten when young by hyenas or other carnivore (Loveridge). According to natives, African Sea Eagles (*Cuncuma v. vocifer*) were responsible for deviscerated shells found on the shores of Lake Victoria (Loveridge).

Leeches commonly occurred on these terrapin at Kaimosi.

Defence. When first alarmed, the Black Terrapin retreats within its shell, but if persistently annoyed it hisses and makes a crunching sound, presumably with its jaws, finally emerging to snap at its tormentor. If held, it scratches and discharges fluid; though the latter action may be due to fear, it may act as a deterrent to predators.

Aestivation. On February 13, at Kaimosi, the first rain for months fell between 4.30 and 5.30 p.m. The following morning a terrapin, its back caked in mud, was found wandering: the deduction that it had just emerged from aestivation appeared warranted by the mud on its carapace.

Disease. Rembold (1908, p. 742) furnishes a photograph and account of a West African "*derbianus*" which developed a sac-shaped swelling on the neck. After two years this swelling attained the size of a beechmast and was accompanied by signs of nervousness, in marked contrast to the creature's previous behaviour, though its appetite remained good. In walking, the swelling was dragged along the bottom of the aquarium by the terrapin, and considerable effort was required for the reptile to raise its head for air. It frequently

rested its head upon some floating cork-bark and evinced an increasing desire to leave the water.

Habits. Somewhat sluggish and secretive, at least the adults which may be found in shallow water at the edge of large ponds at night. Being nocturnal, they feed best in the evening, alternately gorging and fasting according to Rembold, who claims evidence that they have a well developed sense of taste. During the favourable conditions prevailing in the rainy season they are prone to wander. Lang (in Schmidt, 1919, p. 413) states that they rest upon submerged débris or aquatic vegetation with the head and shell partly out of water. Writing of "*bechuanicus*", FitzSimons (1935b, p. 306) states that they could be seen basking on exposed rocks, but slipped into the river before one could get near, being extremely shy. His type was captured with rod and line when he was fishing for barbel. I have never observed this basking habit in the equatorial belt where the waters are presumably warmer.

Habitat. Papyrus swamps, stagnant pools, ricefields, lakes and rivers outside the rainforest in coastal plain and upland savanna.

Localities. **Uganda:** Bunjako; Butiaba (Rutiala); Bussu near Jinja; Bwamba (Wawamba); Entebbe; Sesse Islands (Ussi Id.). **Kenya Colony:** Athi River near Malemboa; Kaimosi; Yala River (M.C.Z.). **Tanganyika Territory:** Bukoba; Dar es Salaam; Kaombwe's village, Nkila, Ukimba; Karagwe (Karawe); Kasanga; Kilosa; Kisaki; Lake Mkwera; Lake Nyasa; Lake Rukwa; Manda (as Wiedhafen); Mtita's village near Dodoma; Mukwese; Mwaya; Sassi, Momba; Tanga (? *sinuatus*); Ukerewe Id, Lake Victoria; Uluguru Mtns. at Nyange; Wiedhafen (see Manda). **Zanzibar:** Pemba Id.: Mbuyuni; Zanzibar.[1] **Seychelle Islands:** Diego Garcia; Gloriosa Id.; La Digue Id.; Mahé Id. **Mauritius. Madagascar** — many localities. **Mozambique:** Beira; Caia; Charre; Lorenzo Marques; Mesuril; Ziweziwe. **Nyasaland:** Shire River. **Northern Rhodesia:** Chambeshi River at Bwela Flats; Lulimalala River at Chiwali's village; Mpika district; Msofu River; Munyamadzi River; Nyamkolo. **Southern Rhodesia:** Gwamayaya River at Gwelo; Mazoe; Mashonaland (as *sinuatus*). **Bechuanaland Protectorate:** Thamalakane River at Maun. **Transvaal:** Aapies River near Pretoria. (M.C.Z.). **Zululand:** Richard's Bay. **Natal:** Durban Bay (Hewitt questions this locality on grounds collector lived in Rhodesia); **Angola:** Ambriz; Bimbi; Chimporo; Chitau; Cubal; Dondo; Duque de Bragança; Elende; Kuvangu; Loanda; Osi; Rio Cuce; Rio Quilo. **Cabinda:** Chinchoxo. **Belgian Congo:** Banana;

[1] Specimen so labelled in Mus. Comp. Zoölogy.

Dika; Dungu River at Faradje; Eala; Kando; Kikondja; Kwamouth; Lake Edward; Lukafu; Mahagi; Manda; Nyonga; Stanleyville. **Belgian Ruanda-Urundi:** Usumbura. **French Congo:** ? **Sao Thomé Id.** and Rolas. **French Cameroon:** also ? (only Sjöstedt's 1897 record of an entirely black 70 mm. terrapin) **Togoland:** Bismarckburg; Kete Kratje; Mangu. **Liberia:** Grand Cape Mtn.; Junk River. **Sierra Leone. French Guinea:** Kerouane; Labe, Fouta Djalon; Tumbo Id. **Portuguese Guinea:** Bissau; Bolama. **Gambia:** Gambia River; MacCarthy Id. **Senegal:** Cape Verde; Rufisque; (Rochebrune's records are omitted). **Cape Verde Ids.:** S. Tiago (Jago) Id. at Praia (Praja) Bay.

Range. West Africa from the Cape Verde Islands and Senegal south to Angola, east to Zululand (and possibly Natal), north to Kenya Colony, also islands of the Indian Ocean, viz. Pemba, Zanzibar, Seychelles, Madagascar and Mauritius.

Pelusios sinuatus (Smith)

1831. *Sternotherus castaneus* Gray (not Schweigger), p. 38.
1844. Gray, p. 37.
1855. Gray, p. 52.
1838. *Sternotherus sinuatus* A. Smith, Ill. Zool. S. Africa, Rept., pl. i: In rivers to the north of 25° S., South Africa.
1851. Duméril & Duméril, p. 19.
1863b. [1]Gray, p. 193, fig.
1864a. Gray, p. 166, fig.
1865. Strauch, p. 109.
1866b. Peters, p. 887.
1869a. Peters, p. 11.
1870. Gray, p. 78, fig.
1873b. Gray, p. 69.
1882a. Peters, p. 8.
1889a. Boulenger (part), p. 194.
1894a. Günther (1893), p. 618.
1894. Günther, p. 85.
1896c. Boulenger, p. 15.
1896. Tornier (part), p. 4.
1897g. Boulenger, p. 277.
1897. Tornier, p. 63.
1898. Jeude, p. 9.
1898. Johnston, p. 361.

[1] The spelling *Sternothaerus* was adopted after this date, various minor misspellings of the generic and specific name are ignored.

1898. Sclater, p. 97.
1898. Tornier, p. 282.
1899. Mocquard, p. 219.
1902b. Boulenger, p. 15.
1902b. Scherer, p. 265, fig.
1903d. Siebenrock, p. 193.
1905h. Boulenger, p. 251.
1907a. Boulenger, p. 6.
1908b. Mocquard, p. 557.
1909. Siebenrock, p. 556.
1911. Lönnberg, p. 7.
1911b. Masi, p. 132.
1912b. Boulenger, p. 329.
1912c. Sternfeld (part), p. 200.
1912b. Werner, p. 470.
1913c. Nieden, p. 55.
1915. Rawitz, p. 665, pl. xlix, figs. 68–75.
1916. Calabresi, p. 42.
1916. Siebenrock, pl. i, fig. 3; pl. ii, fig. 6.
1921d. Loveridge, p. 52.
1923b. Calabresi, p. 150.
1923g. Loveridge, p. 932.
1924b. Loveridge, p. 2.
1925b. Flower, p. 932.
1927. Calabresi, pp. 20, 37.
1930d. Witte, p. 85.
1939b. Rendahl, p. 2, figs. 1–5.

1848. *Sternotherus dentatus* Peters, Arch. Anat. Phys., p. 494: No locality.
1895i. *Sternothaerus bottegi* Boulenger, Ann. Mus. Civ. Stor. Nat. Genova (2), **15**, p. 9, pls. i-ii: Bardera, Italian Somaliland.
1897g. Boulenger, p. 277.
1900b. *Pelomedusa galeata* Tornier (part), p. 583.
1912c. Sternfeld (part), p. 201.
1923g. *Sternothaerus nigricans* Loveridge (part), p. 930.
1928d. Loveridge (part), p. 51.
1927a. *Pelusios sinuatus* Hewitt, p. 360.
1927c. Power, p. 411.
1929h. Loveridge, p. 5.
1931. Hewitt, p. 462, pl. xxxvi, fig. 3.
1933h. Loveridge, p. 208.
1934. Pitman, p. 307.
1935. Hewitt, p. 345.
1936h. Loveridge, p. 19.
1936j. Loveridge, p. 222.
1936e. Parker, p. 607.

1937a. FitzSimons, p. 261, pl. x.
1937f. Loveridge, pp. 489, 492, 495.
1939b. FitzSimons, p. 19.
1927a. *Pelusios sinuatus zuluensis* Hewitt, Rec. Albany Mus., **3**, p. 371, fig. 1d, pl. xx, figs. 1–3: Near Umsinene River, Zululand.
1934a. Mertens, p. 10.
1937b. Mertens, p. 5.
1931. *Pelusios sinuatus sinuatus* Hewitt, p. 462, pl. xxxvi, fig. 3.
1934a. Mertens, p. 10.
1933. *Pelusios sinuatus leptus* Hewitt, Occ. Papers Rhodesian Mus., p. 45, pl. ix, figs. 1–2: Isoka, Northern Rhodesia.
1934. Pitman, p. 307.

Omitted from the preceding bibliography, having been transferred to *subniger*, are records of *sinuatus* from Senegambia (Rochebrune, 1884a); Angola (Bocage, 1895a; Schmidt, 1933; Monard, 1937b); Belgian Congo (Sternfeld, 1912c); Uganda (Tornier, 1896, Boulenger, 1902d, 1909b; Nieden, 1913c); Seychelles (Boulenger, 1889a; Schmidt, 1933; Monard, 1937b); Madagascar (Boettger, 1889, 1893a). All of these regions being outside of its range.

Names. Serrated Terrapin (English); *fulwe* (Jiji); *ngongo* (Konde).

Illustrations. Smith's plate of the type is a good representation of an old individual in which many of the distinctive characteristics of the species are blurred. Boulenger's (1895i) figures of *bottegi* from above and below, give a much better idea of this distinctive terrapin. Gray (1863b) has figured the head, and Siebenrock (1916) the young for comparison with that of *nigricans*, i.e. *subniger*. Rendahl (1939b) furnishes excellent figures of the plastral pattern, particularly that of an aberrant individual (fig. 3).

History. Smith's type of *sinuatus* was recently located in the Royal Scottish Museum (No. 1859.13.1864) by FitzSimons (1937a, p. 261, pl. x), whose redescription, measurements, and figures are invaluable to all workers on the involved tangle centering round its synonymy. I have recently examined the type of *bottegi* in the Genoa Museum (C. E. 2319) and confirm Siebenrock and Calabresi in their decision to refer it to the synonymy of *sinuatus*. Cogent reasons for regarding *zuluensis* and *leptus* as synonyms were advanced by me (1936j, p. 222) some time ago, an opinion which I consider more than ever justified since seeing additional material. Rendahl (1939b) with very limited material, furnishes many measurements of variable characters in contrast with those of *subniger* (which he calls *nigricans* and *castaneus seychellensis*).

Description. Head broad, snout short; a pair of supraorbital shields followed by a very large frontal, flanked by a pair of temporals (rarely subdivided); narrowest interorbital width much less[1] (about two-thirds) than the longitudinal suture between the supraorbitals; upper jaw angularly rounded in young, sometimes notched and bicuspid in adults; chin with a pair of barbels; scales on anterior aspect of fore limb irregular in size; carapace moderately depressed, its height included in its length from 2.39 to 3.68 times, its posterior margin strongly serrate in young, more or less serrated or sinuated except in very old individuals; vertebral shields 5, the anterior 4 keeled, the median 3 more or less protuberant posteriorly, occasionally smooth in old individuals (of 221 mm. or over), as long as, or much longer than, broad in adults, much broader than long in young, first and fifth subequal in length and greatest breadth or broader than long; costals 4 pairs; marginals 22, rarely 24; supracaudals 2; plastron slightly smaller than the opening of the carapace; anterior lobe rounded, not or but slightly projecting beyond the carapace; posterior lobe angularly and deeply notched; intergular shield 1 to 3 times as long as a gular, 1¼ to 2½ times as long as broad, its sides straight or wedge-shaped; humerals forming a suture 1 to 2 times as long as that of the pectorals, outer border of a humeral shorter, rarely slightly longer, than that of a pectoral; pectorals excluded from bridge by abdominals; width of bridge contained 1½ (adults) to nearly 2 times (young) in the width of the plastron; suture between abdominals longer (adults) or shorter (young) than the length of the anterior lobe of plastron.

The above description is based solely on a score of terrapin from Kenya Colony and Tanganyika Territory, yet will be found, I think, to embrace all variations recorded in the literature or in descriptions of subspecies with the exception of those included in the footnote.

Anatomy. The skull (of *zuluensis*) has been described by Hewitt (1927a, p. 373).

Coloration. Above, head yellowish or pale olive finely speckled, striated, or vermiculated with dark brown; limbs drab or yellowish brown flecked with darker; carapace in young, olive green to gray brown turning to dark brown or black in adults. Below, plastron in *very* young terrapin, brick red edged with black, the sutures between the shields broadly edged with white; in young and half-grown, as well as in most adults, the plastron is rich yellow, its periphery edged with black in a very characteristic angular *pattern* whose sharp angles and regular outline become blurred only in very old individuals.

[1] Said to be equal to in *bottegi*, to be less or greater in *zuluensis*.

Measurements. Length of carapace of a Lake Jipe specimen[1], 380 mm. (Peters, 1882a, p. 8) exceeded only by a ♀ from Amani[2] of 383 mm. (Mertens, 1937b, p. 5). My largest, from Ruaha River, had a carapace length of 360 mm., breadth 244 mm., height 138 mm. The largest specimens are said to attain a weight of 20 lbs.

Breeding. Native fishermen at Ujiji informed me that these terrapin come ashore to oviposit in July; this is hardly confirmed by the presence there of two 51 mm. young on March 10, and two 51 mm. young at Mbanja on April 27, unless the period of development is very long.

Longevity. 8 years, 2 months, 27 days (Flower, 1925b, p. 932).

Diet. Scherer (1903b, p. 336) says that a score of young, about 50 mm. long, lived on a diet of raw fish and meat for three months, then lost appetite, refused to eat, and died. He points out that under natural conditions the insects, snails and fish upon which they feed, probably supply calcium and vitamins essential to growth. Larger terrapin of 80 mm. or more in length, throve on worms, fish and raw meat. Frogs are apparently taken, see Loveridge (M.S.S.).

Enemies. At Ujiji, some natives admitted eating these terrapin, others scornfully denied doing so.

Defence. A 173 mm. terrapin, when picked up and turned over, ejected a fine jet of fluid from its right axilla or shoulder to a distance of one foot, a second jet followed from the region of the left fore leg, than a third from the right hind leg. Usually on being disturbed, a terrapin will withdraw and enclose its head and fore limbs within the shell, in my experience never attempting to use its strong jaws for defensive purposes. Scherer (*l.c.*) states that they make low moaning noises — which he thought originated in deep breathing — when within the shell.

Habitat. Lakes and the larger rivers in the coastal belt and upland savanna, to 5,000 feet.

Localities. **Italian Somaliland:** Bardera; Bulo Burti; Dolo; Imi; Juba River; Lugh; Webi Mana. **Kenya Colony:** Archer's Post; Athi River near Malemboa; Bulessa; Galass waterhole near Lake Rudolf; Guaso Nyiro; Juja Farm; Tsavo River; Ukamba. **Tanganyika Territory:** Amani[2]; Dar es Salaam; Kaombwe's village, Nkela, Ukimba; Kasanga; Kilimanjaro; Lake Jipe; Lake Rukwa; Lake Tanganyika; Little Ruaha River; Mombas River near Sassi;

[1] Not 385 mm. as stated by Rendahl (1939b, p. 2, footnote).

[2] I would suggest that this specimen more probably came from the Sigi River below Amani and was taken up the mountain to sell by a native.

Morogoro; Muhesa; Pangani River; Ruaha River; Ruvu River; Ruvuma River; Tanga; Ujiji; Usambara. **Belgian Ruanda-Urundi:** Usumbura. **Mozambique:** Boror; Mesuril; Quelimane; near Tette. **Nyasaland:** Shire Highlands. **Northern Rhodesia:** Isoka; Munyamadzi River; Petauke. **Southern Rhodesia:** Mt. Chirinda; Sabi River at Birchenough Bridge; Salisbury district. **Bechuanaland Protectorate:** Lobatsi (seen); Notuani River mouth in Limpopo Valley. **Transvaal:** Gravelotte; Koedoeopoort near Pretoria; Letaba River near Rubber Vale; Malta near Leydsdorp; Mawobya Creeks, Great Letaba Rivers; Naboomspruit; Vaalwater, Waterberg (M.C.Z.). **Zululand:** Black Umfolosi River at 6 k.m. from Majimba Hill; Umfolosi Station; Umsinene River. **Natal:** Port Natal.[1]

Records from Senegambia, Angola, Belgian Congo, Uganda, Seychelles and Madagascar, as listed on p. 504, are rejected, having been based, so far as I have been able to ascertain, on examples of *subniger*.

Range. East Africa from Italian Somaliland south to Natal, west to Lake Tanganyika (but not Lake Victoria for Tornier (1896) and Boulenger's (1909b) records from Sesse (Ussi) Islands, and Tornier (1896) and Roux (1910) records from Bukoba were based on *subniger*). Absent also from the Seychelles and Madagascar.

[1] See footnote to key.

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